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CLEAN AIR ACT: OZONE AND PARTICULATE MATTER STANDARDS

HEARINGS

BEFORE THE

SUBCOMMITTEE ON
CLEAN AIR, WETLANDS, PRIVATE PROPERTY AND NUCLEAR SAFETY

AND THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIFTH CONGRESS

FIRST SESSION

APRIL 24 AND 29, AND JULY 24, 1997

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CLEAN AIR ACT: OZONE AND PARTICULATE MATTER STANDARDS

THURSDAY, APRIL 24, 1997

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY AND NUCLEAR SAFETY,
Washington, DC.

RISK ANALYSIS AND IMPLEMENTATION ISSUES

The subcommittee met, pursuant to recess, at 9:33 a.m. in room 406, Senate Dirksen Building, Hon. James M. Inhofe (chairman of the subcommittee) presiding.

Present: Senators Inhofe, Hutchinson, Allard, Sessions, Lieberman, and Chafee (ex officio).

Also present: Senator Baucus.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. The hearing will come to order.

Today's subcommittee hearing is the third on the proposed rule changes. It's actually the fourth hearing that we've had; one was a full committee hearing.

The first was the science hearing, in which we heard from members of CASAC, and there are some members from CASAC here today as well as much of the scientific community.

At the second hearing, Administrator Browner was the Administration's first witness. The committee then held a field hearing in Oklahoma City. In fact, I think we set a record for the longest and the best attended field hearing in the history of Oklahoma. Today, we turn to risk and implementation issues. This will be followed by a hearing this coming Tuesday, April 29, which will focus on the impacts of the proposed regulations by EPA.

I'm troubled by the risk issues surrounding these regulations. The risk analysis is necessarily based on the understanding of the science issues, but we learned in our science hearing that there is great uncertainty on the scientific side. When we add that to the uncertainties in the risk assessments, we end up with very dubious results.

We have learned that the EPA greatly overestimated the impacts of both ozone and PM and they've had to publicly change their figures. In addition, we've learned that they selectively applied some study results, while ignoring others in their calculations.

For example, the majority of the health benefits for ozone are based on one study by Dr. Moolgavkar even though the Agency ignored the results of that study because it contradicted their position.

What I find most troubling is that first, the science is unclear and incomplete, and then these uncertainties are added to the uncertainties of risk calculations.

The EPA has claimed these results are concrete facts, even though other Federal agencies and outside interest groups have raised many questions about these proposals. Public policy decisions must be open and aboveboard. Uncertainty in science, plus uncertainty in risk factors does not equal certainty.

What I hope to gain from the testimony of the first panel today is a better understanding of the risk issues. I am pleased that we have some divergent viewpoints by members of the panel and hope they can shed some light on the risk issue.

The second panel today will discuss the implementation issues. This area has not received the attention it deserves in the public debate. While implementation issues will become more important as the EPA proceeds, they do need to be discussed before the proposals are finalized. Because of that, we have invited several members of the EPA's Advisory Group for Implementation Issues to appear here today.

I'm concerned that the planned implementation for these proposals is not reflected in the projected impacts. The EPA is planning to change the method of defining nonattainment areas. The proposals have created two new concepts—areas of violation and areas of influence.

[Indicates chart.]

Senator INHOFE. If you look over here, we don't have the entire United States; this is a chart I understand that came from the EPA and we talk about the very small circle in the middle as being those areas that could be out of attainment but it's very vague on what is expected in the other areas.

This chart represents what the EPA is considering for implementation areas. If members have not seen this, I suggest you look closely and particularly you, Senator Sessions, because you don't really know what additional problems are going to be there.

Most people have been under the wrong assumption that these proposals would only affect the nonattainment areas defined by the EPA. As you can see on the map, from only three nonattainment areas, the majority of five States would be affected. While this is only a strawman map and as it says on the top, "conceptual only," the concept concerns me. The boundaries themselves could end up being larger or smaller. The fact that it's being considered needs to be addressed.

The people who live in these areas, as well as the mayors, Governors, and even Senators, have had no idea that these regulations would apply to them. The importance of this cannot be underestimated. The people in these communities lost the opportunity to comment during the comment period. I suspect that if a lot of people had seen that map prior to the end of the comment period, there would have been a lot more comments.

I hope this issue as well as other implementation issues will come out during our second panel. We have two good panels of witnesses today and I look forward to your testimony.

[The prepared statement of Senator Inhofe follows:]

PREPARED STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

The hearing will now come to order.

Today's hearing is the third subcommittee hearing on the proposed new ozone and particulate matter standards and the fourth for the Committee. The first hearing focused on the scientific issues. At the second hearing, a full Committee hearing, we received testimony from Administrator Browner. The third hearing was a field hearing in Oklahoma City where we received testimony from State and local government officials.

Today we turn to risk and implementation issues. This will be followed by a hearing this Tuesday which will focus on the impacts of the proposals.

I am troubled by the risk issues surrounding these regulations. The risk analysis is necessarily based on the understanding of the science issues. But we learned in our science hearing that there is great uncertainty on the scientific side. When we add that to the uncertainties in the risk assessments, we end up with very dubious results.

Since our last hearings, we have learned that the EPA greatly overestimated the impacts for both ozone and PM, and they have had to publicly change their figures. In addition, we have learned that they selectively applied some study results while ignoring others in their calculations. For example, the majority of the health benefits for ozone are based on one PM study by a Dr. Moogarkar, even though the Agency ignored the PM results of that study because it contradicted their position on PM.

What I find most troubling is that first the science is unclear and incomplete and that these uncertainties are then added to the uncertainties of risk calculations which must result in great uncertainty. But the EPA has postured these results as being the concrete facts, even though other Federal agencies have raised as many questions about these proposals as outside interest groups. Public policy decisions must be open and above board. Uncertainty in science plus uncertainty in risk does not equal fact.

What I hope to accomplish in the first panel today is a better understanding of the risk issues. I am pleased that we have some divergent viewpoints on the panel. I hope they can shed some light on the risk questions.

Our second panel today will discuss the implementation issues. This is an area that we have so far ignored and is not receiving the attention it deserves in the public debate. While implementation issues will become more important as the EPA precedes, they do need to be discussed before the proposals go final. Because of that, we have invited several members of the EPA's advisory group for implementation issues to appear here today.

I am concerned that the planned implementation for these proposals is not reflected in the projected impacts. The EPA is planning to change how nonattainment areas are defined. The proposals have created two new concepts, Areas of Violation and Areas of Influence.

This chart, represents what the EPA is considering for implementation areas. If members have not seen this, I suggest you look closely. In addition to requiring control measures in nonattainment areas, the EPA plans on requiring additional measures in these Areas of Influence. Most people have been under the wrong assumption that these proposals would only effect the nonattainment areas identified by the EPA. But as you can see on this map, from only three nonattainment areas, the majority of five States would be affected. While this is only a straw man map, and as it says on the top, conceptual only; the concept concerns me. The boundaries themselves could end up being larger or smaller, the fact that it's being considered needs to be addressed.

The people who live in these areas, as well as the mayors, Governors, and even Senators have had no idea that these regulations would apply to them. The importance of this cannot be underestimated. These people and communities lost the opportunity to comment during the public comment period because their counties were not identified by the EPA as nonattainment areas. These proposals have been portrayed as only affecting certain areas when, in fact, they will impact the entire Nation.

I hope this issue, as well as other implementation issues will come out during our second panel. We have two good panels of witnesses today and I look forward to your testimony.

Senator INHOFE. I will now turn to Senator Hutchinson for any opening comments he might want to make.

OPENING STATEMENT OF HON. TIM HUTCHINSON, U.S. SENATOR FROM THE STATE OF ARKANSAS

Senator HUTCHINSON. Thank you, Mr. Chairman.

I want to commend you for your willingness to take on this very difficult issue. Too often, I think regulatory agencies are able to implement new standards and new regulations without any close scrutiny or necessarily the kind of focus that should be placed upon them. So thank you for leading this and for calling this issue today.

I'm very happy that we can continue our study of the EPA's proposed clean air standards. About 2 months ago, we held the first hearing on the proposed standards. In this hearing, I learned very important information regarding the scientific basis behind the EPA's proposal.

It was very clear that the CASAC scientists themselves did not agree on the standards proposed and they certainly did not agree that everything EPA has done is in accordance with the recommendations of CASAC.

I must admit that in some ways I am amazed that we're still debating some of the issues that we are today. Since the science hearing, it has come out that several Government agencies have opposed these standards with, to my knowledge, no response from EPA. I've heard from hundreds of constituents, not just industry officials but the average citizen, strongly opposed to these new standards.

I've seen editorials and articles from papers all over the Nation outlining weaknesses in the proposal and opposition to it. All of this has gone on in the last 2 months, yet we've heard very little from EPA. There's been no good faith effort, in my opinion, on the part of EPA to address these very legitimate concerns.

I find this situation disturbing, especially the lack of response to the Government agencies opposing the standard. Instead, we have heard Administrator Browner claim that they have the scientific basis and justification for the standards. Unfortunately, this science is considered in many cases either valid, weak, or contradictory.

In Arkansas, the EPA has become one of the most despised agencies. Perhaps in the month of April with IRS, it might exceed the hostility level, but the EPA is viewed as being heavy-handed, oftentimes arrogant and it seems this level of disrespect I think goes beyond the average Arkansan.

Recently, I found out that some of the comments made by Dr. Schwartz in the first hearings were misleading at best. He testified that the United States is behind the rest of the world in clean air standards. Now we come to find out that is really not the case at all and yet Dr. Schwartz testified and led us in that direction—I think misled us in that direction.

It troubles me and I think it should concern every Senator on this committee and every Senator in the U.S. Senate. Dr.

Schwartz's studies are the primary studies the EPA has used to set the PM standard. Yet, these studies have not yet been made public. We are relying, in effect, on unchecked research of someone who has not been fully forthcoming to this committee. This concerns me greatly. I think Dr. Schwartz should provide us an explanation or an expansion on his comments to us.

In the first hearing, I submitted a question to Mr. McClellan regarding the possibility that under certain circumstances, even if all manmade VOCs, volatile organic compounds, were eliminated, would it be possible for some regions of the country to find themselves out of attainment and he responded that was the case.

Basically, under the current Clean Air Act, some areas could do everything possible to eliminate manmade VOCs and still be out of attainment. The EPA is determined that for these areas NAAQS must be regulated.

What that would basically mean is that the Clean Air Act would have to be reopened. I don't think we desire to do that in order to regulate this area.

Mr. Chairman, in short, there are many unanswered questions on these standards and I'm really surprised that there has been no attempt on the EPA's part to really come to the table and discuss the issues that have been raised and the concerns that have been expressed by this committee.

I want to thank you for the opportunity to continue the hearings and to continue to explore what I think will be a far-reaching impact upon not only our local and State governments, but upon each of our citizens.

Senator INHOFE. Thank you, Senator Hutchinson.

I also thank you for attending the field hearing out in Oklahoma. Out there, we saw what the people in the field thought. I might add at this point, this is not a partisan issue. The second panel we had in our Oklahoma field hearing, all of them were Democrats and they had very, very strong feelings, as you recall.

Following the "early bird" rule, we'll turn now to Senator Sessions.

OPENING STATEMENT OF HON. JEFF SESSIONS, U.S. SENATOR FROM THE STATE OF ALABAMA

Senator SESSIONS. Thank you, Mr. Chairman.

I'd like to thank you for your work on this important issue. We're moving along very fast and I'm afraid we're considering adopting issues that could have great impact on our communities.

It was remarkable that I think we had the official representative of the National League of Cities speaking strongly in opposition to the proposed regulations.

Senator INHOFE. And the U.S. Conference of Mayors.

Senator SESSIONS. And the State Legislatures, from Representatives, the chairman of the environmental committees, national presidents of those organizations, as I recall, were absolutely and firmly in opposition to it and had some very disturbing things to say about the possibilities that these regulations would impact adversely their growth and economic vitality.

Obviously, what we've learned is that nations that are strong and healthy economically do a better job of cleaning up their envi-

ronments. If you're doing well financially, you can afford to make the investment easier than you can if you're not and the poorer nations, we can see, just simply are not able to do so. So we need not underestimate the damage that can be done if we impose regulations that don't improve health commensurate with the economic burden that it may place on our people and our industries.

We should note in a very positive way how much the air has been cleaned up in the past 25 years. Measured pollutants have been reduced nearly one-third with sulfur dioxide, the main precursor, to acid rain being reduced by 30 percent and particulate matter being reduced 78 percent.

The standards we have in place now are working and many, many communities are continuing to clean up their air. Moving forward with these changes will affect the lives of many people. We need to make sure that we are, in fact, receiving health benefits.

We want to hear from these panels, but I will say this—it's important to me that the Environmental Protection Agency, when it states its position before this committee, that its numbers are verifiable.

EPA is suggesting, for example, in their cost-benefit analysis that they have done, that implementation of this standard will cost $6 to $8 billion. I met with the environmental person for TVA. It would cost $2 billion alone for TVA to comply with these new standards. One of the power companies in the southeast said it would probably cost them $4 billion. Other estimates have been $60 to $100 billion to meet these standards.

We need to get better numbers. We need to get better numbers about health; we need to get better numbers about costs, and we need to make sure that the policy we're setting today as public officials is based on science and health and not on politics or other reasons.

Senator INHOFE. Thank you, Senator Sessions.

Senator Allard.

OPENING STATEMENT OF HON. WAYNE ALLARD, U.S. SENATOR FROM THE STATE OF COLORADO

Senator ALLARD. Thank you, Mr. Chairman.

I want to thank you for continuing to seek to get the scientific truth on these issues as chairman of this committee. I commend you in your efforts in that regard.

I do have a full statement for the record, and I will make a few brief comments.

Senator INHOFE. Without objection.

Senator ALLARD. We've heard from the Environmental Protection Agency earlier, specifically from Carol Browner, and I was one member of the committee who challenged the scientific basis for some of the claims she was making and challenged her to come up with some better science. Instead of coming up with better science, she just downgraded her figures.

This is not a political give-and-take situation as much as this committee is searching for good, scientific evidence to help us in making the right decisions, to ensure the health of the people of this country. I'm looking forward to being able to review the record, and I commend you for seeking that science.

The other comment I'd like to make is I think those regulations being promoted by the Environmental Protection Agency set up local governments, particularly States, to fail because I'm not convinced they have the technical ability to actually meet the challenge that is called for in the rules and regulations.

Again, we're getting down to the best available technology and the ability of the States to carry forward with that technology and good science.

Those are just some of the brief comments I have. I'm going to have to leave early because of this debate—I serve on the Intelligence Committee. I apologize to the panel members for not being here.

I do have some questions that I'll ask the committee and my staff to submit to those who are testifying.

Thank you, Mr. Chairman.

[The prepared statement of Senator Allard follows:]

PREPARED STATEMENT OF HON. WAYNE ALLARD, U.S. SENATOR FROM THE STATE OF COLORADO

Thank you, Mr. Chairman. Today's hearing is of great interest to me because we will focus on the nuts and bolts of the proposed regulations; first whether they will actually contribute to better health and second whether they can be implemented effectively. Also, this will allow me the opportunity to follow up on questions concerning the Grand Canyon Visibility Project Commission that I had for Administrator Browner in early February.

First, is the issue of the health benefits that have been projected if these regulations should be implemented. I believe we have given the EPA every opportunity to prove that the benefits they claim will actually occur. Instead of proving their original claims they have downgraded them and witnesses today will testify that even these revised numbers may not hold up under scrutiny. If the EPA is uncertain, I think Congress has the obligation to approach their proposal with some skepticism.

Second, the implementation of these regulations could very well place too much of a burden on States and set them up for failure. My view is that EPA should not run out in front of the States' technical ability to implement Federal regulations. Further, testimony that we will hear today indicates to me that the limited technical and financial resources of State governments was not considered before these rules were proposed.

Finally, I am still concerned with regional haze issues. I have a series of questions on this matter and, should I have the time, I look forward to posing them to Ms. Nichols.

Thank you again, Mr. Chairman.

Senator INHOFE. Thank you, Senator Allard. I also have a statement from Senator Boxer that will be placed in the record.

[The statement of Senator Boxer follows:]

PREPARED STATEMENT OF HON. BARBARA BOXER, U.S. SENATOR FROM THE STATE OF CALIFORNIA

Mr. Chairman, I believe that as Senators, we have no greater duty and responsibility than to protect the health and safety of the American people.

With this in mind, I would like to make two points today.

First, I want to say very clearly and strongly that EPA clean air standards must continue to be based on science and health concerns.

The EPA proposal before us is based on the best available science regarding the health effects of exposure to ozone and particulate matter. Some argue that we should not set a new standard until we have scientific proof of the exact relationship between exposures to ozone and particulate matter, and health effects. If we had applied that principle in the late 1970's, we would not be enjoying the benefit of our current standards—which have led to, for example, air pollution from carbon monoxide being reduced by 28 percent, from sulphur dioxide 41 percent, and from lead 98 percent.

We must continue medical research to improve our understanding. We clearly need more monitoring data on particulate matter. But this should not make us lose our focus on the need to continue making progress and further protect the public health—especially our children.

Young children constitute the largest group at high risk from exposure to air pollutants. They breath 50 percent more air by body weight than the average adult. In California alone there are over six million children under the age of 14 and approximately ninety percent of them live in areas that fail to meet State and Federal standards.

The second point I want to make, is the importance of taking costs into account once the health-based standards are set. Costs should and will play a key role in how the standard will be implemented and how long States will have to comply.

In California, the South Coast Air Quality Management District is responsible for cleaning up the L.A. basin, which has the most polluted air in the country. The South Coast Air District faces some of the most intractable and complex air pollution problems, in an area where nearly every possible source is already regulated. Yet the District supports the EPA proposal. Why? Because they believe that more stringent standards can be met as long as technology continues to develop, and the State is given sufficient time to develop an implementation plan that is cost effective.

Mr. Chairman, I think we need to continue to listen to all sides in this debate before we make a final judgment. I am confident that EPA will seriously consider each one of the thousands of public comments it has received before making a final proposal.

Lastly, I want to welcome Pat Leyden, the Deputy Executive Officer of the South Coast Air Quality Management District who will testify in the second panel. I think she makes key points in her testimony about the effectiveness of market-based strategies to reduce emissions—in particular the Regional Clean Air Incentives Market (RECLAIM) program.

I look forward to continued work with Committee members on this important issue.

Thank you.

Senator INHOFE. We will be moving this right along because I think most people are aware that we're having an executive session on the Chemical Weapons Convention today and we want to get up there in time for that.

I'd ask our first panel of witnesses if you'd take your places at the table. The way we have divided the panels today is to start with experts in the field of risk analysis. The second panel will consist of persons responsible for implementation of the proposed standards should they be issued.

While you're coming forward, I'd like to give you an overview of how we will proceed during this public hearing.

We have 12 witnesses today, so what we're going to try to do is your entire statement, as you've been told, will be submitted for the record, but we will be timing witnesses and we're asking you to stay within the time limit for your opening statement of 5 minutes. These lights will give you the designation as to when you should stop.

Following 5 minutes of comments by each of the witnesses, I will then ask any member of the subcommittee if they'd like to ask questions. Then we will have a round of questions and answers.

I think we're ready to begin, so let me introduce the members of the first panel. We have Dr. Kenneth Chilton, Center for the Study of American Business, Washington University. I put two kids through that university.

Next is Dr. Alan Krupnick, Resources for the Future; Dr. Thomas Star, principal, ENVIRON Incorporated; Ms. Susan Dudley, Economists Incorporated; Dr. Carl Shy, Department of Epidemiology, School of Public Health, University of North Carolina at Chapel

Hill; and Dr. Morton Lippmann, Institute of Environmental Medicine, New York University.

With that, we will start with Dr. Kenneth Chilton.

STATEMENT OF DR. KENNETH W. CHILTON, DIRECTOR, CENTER FOR THE STUDY OF AMERICAN BUSINESS, WASHINGTON UNIVERSITY, ST. LOUIS, MO

Dr. CHILTON. Thank you, Mr. Chairman.

I'm in your debt for being able to testify today but after hearing that you have had two daughters attend Washington University I understand that you may well be in our debt as well.

I'm the director at the Center for the Study of American Business at Washington University in St. Louis. I've been researching clean air issues for some 15-odd years. The comments I'm making this morning, of course, are my own and not necessarily those of the Center or of Washington University.

The scientific evidence on ozone, I believe, is extensive. Ozone can cause coughing, wheezing, tightness in the chest, reduced lung function, which is reduced volume of air exchanged with each breath. These effects are related to both ozone concentrations and exercise levels. Healthy people typically experience less than a 5-percent loss in lung function, even when exercising vigorously at levels that are twice the current standard.

Doctors don't consider loss of lung function of 10 percent or less a significant health effect. The person would not notice a loss this small.

The primary concern, of course, is for the effects on asthmatics and others who are especially sensitive. The EPA staff report estimates that for each 1 million persons exposed, we can expect just 1 to 3 more respiratory hospital admissions a day for each 100 ppb increase in ozone levels.

This is actually a very low incidence rate and a very high elevation in ozone levels. This effect has been translated, as everyone here knows, to the expected numbers of added annual asthmatic hospital admissions for the New York area. EPA projects that attainment of the new standard would lower admissions to 300 per year. This is just 1/10th of 1 percent of the 28,000 yearly asthmatic admissions in New York City—a very, very small number.

On fine particles, the science is not so well developed, as you know. The EPA still projects, however, significant reductions in premature mortality to result from meeting a new fine particle standard. These projections are based not on thousands or even hundreds of studies but, in essence, two.

These reports indicate an association between $PM_{2.5}$ levels and death due to cardiovascular and pulmonary causes together and also a link between $PM_{2.5}$ and death from all causes. It's curious that the link is not between fine particles and death due to respiratory disease or lung cancer alone. Medical science has not yet discovered a plausible mechanism to explain how fine particles cause any deaths.

These studies also fail to control for other variables, temperature, humidity, or the existence of other air pollutants—that may cause the mortality rates to rise and fall with, and thus appear to be caused by, fine particle concentrations.

The lack of air quality data for $PM_{2.5}$ is another serious problem. EPA Administrator Browner, when she testified here, said that there are 51 $PM_{2.5}$ monitors collecting air quality data at present. That contrasts with 972 ozone monitors and 1,737 PM_{10} monitors. EPA had to project $PM_{2.5}$ concentrations for many cities in order to derive its mortality estimates.

Let me get to the recommendations. EPA is not required to tighten the ozone standard or to create a new $PM_{2.5}$ standard. For ozone there is little evidence that a tighter standard is warranted and would be more protective.

For fine particles, the science is just not adequate to warrant a new standard. More could be accomplished for public health by staying the course for another 5 years than by disrupting this process with a new set of targets.

However, the most important issue being raised by these air quality standards reviews is, by and large, being ignored, I believe. As you're well aware, the Clean Air Act requires the Environmental Protection Agency to establish and enforce air quality standards that protect public health with an adequate margin of safety. That's the mandate.

In that process, it proscribes the consideration of economic factors. This is a very high-minded objective. It sounds good to say that air quality standards are to be set only on the basis of public health, but responsible public policy requires balancing incremental benefits and incremental costs. Spending more on one activity than it brings about in added benefits means that resources aren't available for other beneficial uses.

Current ozone standards already require expenditures between $4 and $28 to produce $1 in health benefit. The tighter standard proposed only worsens this unfavorable tradeoff.

Moreover, the physical responses to ozone can be demonstrated at levels produced by natural processes. As a result, the prime directive of the Clean Air Act has become mission impossible for ozone.

The Clean Air Act Scientific Advisory Committee put it this way. "The paradigm of selecting a standard at the lowest observable effects level and then providing an adequate margin of safety is no longer possible." I suppose CASAC would call this "paradigm impossible" instead of "mission impossible."

In my opinion, EPA should appeal to Congress to reform the Clean Air Act. The Act's fundamental objective needs to be changed from this wishful thinking of protecting the public health with an adequate margin of safety to protecting the public health against unreasonable risk of important adverse health effects. Benefit costs analyses should be required, not proscribed, when setting air quality standards.

The American people expect to be protected from air pollution that might significantly impair their health. They do not expect, however, that the cost of doing so will be all out of proportion to the benefits.

Thank you.

Senator INHOFE. Thank you, Dr. Chilton.

We've been joined by the Chairman of the full committee, Senator Chafee. Senator Chafee, do you have any comments to make before we hear from our next witness?

OPENING STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Senator CHAFEE. Mr. Chairman, I don't want to interrupt. I do have a statement which I will ask be put in the record.

I want to thank you for holding these hearings in your subcommittee.

Unfortunately, I can only stay a short time, but I did want to come by and see what's up and obviously I will have the advantage of reading the testimony that's been submitted.

Thank you very much.

[The prepared statement of Senator Chafee follows:]

PREPARED STATEMENT OF HON. JOHN H. CHAFEE, U.S. SENATOR FROM THE STATE OF RHODE ISLAND

Mr. Chairman, one of the most troubling aspects of this complicated EPA proposal is the mismatch between the public health threat that is presumably posed by fine particles and the schedule for actually reducing emissions of this pollutant.

On the one hand, Administrator Browner has told us that 15,000 Americans are killed each year by elevated levels of particulate pollution and tens of thousands more are hospitalized. Although many have urged that her decision now scheduled for July be postponed so that we could expand the scientific foundation for a new standard, EPA speaks of the problem in terms that communicate a public health emergency.

On the other hand, we will learn at this hearing that the first regulations to actually reduce fine particulate pollution under the Clean Air Act will not be in place until the year 2005 or later. Today, we have few monitoring stations that can measure fine particulate pollution. Once the monitors are put in place, we must collect data for 3 years to determine which areas violate the new standard. States with nonattainment areas are then given 3 more years to write plans to reduce emissions. And it is only after EPA has approved these plans—a step that frequently takes a year or more—that regulations to improve air quality are adopted by the States.

This is a very important hearing because it allows us to explore the apparent disconnect between the rhetoric used to describe the problem and the timeline for acting on solutions. One lesson that we may take away from this hearing is that we do have time to improve our understanding of the health threat posed by this type of pollution before we commit vast sums to a new regulatory program. In my view, it is very important that we make the best possible use of this window for better science. Attaining this new standard for fine particulates everywhere in the Nation would take a very substantial effort—perhaps $20 billion per year or more. EPA will not be able to follow through on that kind of effort without a substantial public consensus as to nature of the health threat. That consensus does not exist today. But it can be built with more science and public education.

Senator INHOFE. Thank you very much, Senator Chafee.

Dr. Thomas Starr.

STATEMENT OF THOMAS STARR, PRINCIPAL, ENVIRON INCORPORATED

Dr. STARR. Good morning.

The comments I offer today are drawn principally from two recent consulting projects in which we conducted a critical examination of the scientific evidence for potentially causal associations between particulate matter exposure and adverse human health effects.

In the first, undertaken on behalf of the American Petroleum Institute, three world renowned epidemiologists—Drs. Raymond

Greenberg from the Medical University of South Carolina; Jack Mandel from the School of Public Health at the University of Minnesota; and Harris Pastides, School of Public Health at the University of Massachusetts—were brought together as an expert panel to independently and objectively assess the quality of the epidemiological evidence for associations between PM exposure and increased human morbidity and mortality.

In the second project undertaken on behalf of Kennecott Corporation, an ENVIRON colleague, Dr. Larisa Rudenko and I also evaluated the case for such associations.

In addition, we assessed the credibility of the health benefits that EPA has projected that would accrue from implementation of the proposed new standards for PM. My remarks today briefly summarize our findings. I refer you to the full report that I submitted to the committee for additional details.

First, let me address the issue of causality, that is, whether the effects observed are truly caused by exposure to PM or specifically $PM_{2.5}$ or some other component of air pollution or lifestyle.

In assessing whether the results from epidemiological studies support a causal relationship, criteria developed initially by Sir Austin Bradford Hill are often applied. These include the strength, consistency, coherence, specificity, and temporality of the reported associations.

Although not explicitly stated, the presumption exists that the validity of the association has been established prior to consideration of these other criteria. What this means is that estimates of the association strength have been shown to be free of significant biases and not significantly confounded by other variables.

Our expert panel of epidemiologists and our own independent review both concluded that the studies of PM and human disease do not satisfy these conditions. They have inadequately addressed potential biases and they have failed to resolve satisfactorily the issue of confounding.

Even if the issue of validity were to be set aside, the health criteria would still not be met. The reported associations are extremely weak; they vacillate between positive and negative based on the specific regression model that is used. As additional co-pollutants are introduced, apparent positive associations with PM attenuate in magnitude often to nonsignificance. Indeed, based on the criteria and strength of association, it's difficult to imagine a weaker case for causality than that posed by the data for particulate matter.

Furthermore, the results of the studies are not actually as consistent as they might at first appear. For example, different exposure measures—mean daily level, maximum daily level, or some lagged estimate of TSP, PM_{10}, $PM_{2.5}$—have been linked with different end points such as respiratory disease, cardiovascular diseases, or total death.

Also, temporal relationships between exposure and disease are not the same across studies, but with lag times varying from zero to several days earlier.

In addition, a critically important component of coherence, a dose response, is at best weakly established only in a few studies. In virtually all of the epidemiological studies of PM, exposure levels have

not been based on personal dosimetry but rather on stationary samples located in specific geographic areas.

Individual subjects were thus assigned communitywide measures of exposure rather than individual measures. The lack of personal exposure limits the ability to conclude that any individual death or disease is linked to air pollution per se. In fact, there is a large body of data indicating that community sampler measurements rarely provide good estimates of individual exposures.

Even if a causal association were to exist, these ecological exposure estimates that have been used would likely misrepresent the associations of truth strength. Equally important, the underlying dose response relationship may be significantly distorted with sharp, thresholdlike curves being smoothed into nearly linear shapes by exposure misclassification.

Another major challenge to the case for causality relates to the fact that PM exposure invariably occurs in combination with exposure to other air pollutants such as ozone, carbon monoxide and sulfur dioxide. Because this mixture composition varies according to the source, the season, time of day, weather conditions and geographic region, and because PM is, itself, a complex and highly variable mixture, it has been virtually impossible to disentangle the potential adverse effects of PM or a specific fraction like $PM_{2.5}$ and those attributable to other confounding copollutants.

The question of whether the course or fine particulate fractions are causally related to human health effects is one of great importance. If there is a causal relationship, then identification and establishment of a safe and acceptable level of PM will be a decision with enormous consequences.

However, the severe limitations of existing studies prevent a conclusive judgment about causality. EPA's proposal for new PM standards is premature.

The stated purpose for EPA's proposed standards is to provide increased protection against a wide range of PM-related effects. How confident can we be that the proposed new standards will lead to increased human health protection? The quantitative assessment conducted for EPA Abt Associates attempted to quantify the uncertainty inherent in the estimated health benefits from the new standards.

This assessment is very thorough in its identification of the many weaknesses in the underlying data, remarkably frank about its necessary reliance on unproven assumptions, and surprisingly even-handed in its demonstration of the sensitivity and uncertainty analyses that the projected benefits might well be greatly exaggerated.

Significant limitations of the benefit projections include the following. The projections have had to assume causation. Future reductions in specific PM levels need not necessarily result in any material health benefits.

Senator INHOFE. Dr. Starr, you have to wind up here. You're going over your time. I think you may have an opportunity in the question time to cover that.

Dr. STARR. Faced with such great uncertainty in the estimated magnitude of potential health benefits, it seems far more reasonable to me for EPA to initiate additional data collection and analy-

sis activities on the health effects potentially associated with PM exposure.

Implementation of the new standards could well make things worse rather than better.

Senator INHOFE. Thank you, Dr. Starr.

For those of you who are standing, there are many seats available, so feel free to sit down.

Susan Dudley.

STATEMENT OF SUSAN E. DUDLEY, VICE PRESIDENT AND DIRECTOR OF ENVIRONMENTAL ANALYSIS, ECONOMISTS INCORPORATED

Ms. DUDLEY. Good morning, I'm Susan Dudley.

I'm vice president and director of Environmental Analysis at Economists Incorporated. I have 20 years experience evaluating and developing environmental policy. In my career I've worked at both the Environmental Protection Agency and the Office of Information and Regulatory Affairs at OMB.

Today, what I'd like to do is highlight a few key points from an analysis I conducted on EPA's ozone rule for the Regulatory Analysis Program at the Center for Study of Public Choice at George Mason University.

This is a research and education program dedicated to advancing knowledge of regulations and their impact. It produces careful and independent analyses of agency rulemaking proposals from the perspective of the public interest. I would like, if I could, to put a copy of our comments in the record of these proceedings.

Senator INHOFE. Yes, without objection.

Ms. DUDLEY. These comments, as well as the program's comments on the particulate matter rule, are also available on Economists Incorporated's web site.

Today, I'd like to highlight three major points regarding the risk assessment underlying EPA's proposed ozone standard.

First, there is little scientific basis for the selection of the level of the standard. EPA recognizes that the selection of .08 ppm was a policy decision rather than a scientific decision. EPA's Science Panel did not find this level to be significantly more protective of public health than the current level of the standard. Moreover, most members of the panel who expressed an opinion preferred a level less stringent than that which EPA has proposed.

Second, EPA's risk analysis suggests that the health and welfare benefits of this proposal will be small. The general population would not notice the difference in air quality as a result of the proposed standard and that's because, as Ken Chilton has said, the effects of ozone appear to be reversible and largely without symptoms for the majority of the population.

Even for the population with the greatest risk, those with preexisting respiratory conditions, EPA expects the impact of the proposed change to be small. For example, with full implementation of the rule, which EPA does not expect for at least a decade, probably many, many decades, EPA predicts a .6-percent decrease in hospital admissions for asthmatics. Furthermore, evidence from animal studies suggests that long-term exposure to ozone does not affect lung function.

Our third point is that the proposal may actually harm public health and welfare. The rule is based on risks to asthmatics, yet ozone is certainly not a determining factor in asthma. Asthma has been increasing over the last decade, especially among poor urban children, yet ozone has been declining steadily over the same period.

NIH recently conducted a study that found the leading cause of asthma by far was proteins from cockroach droppings and carcasses, not air quality. Thus, this rule is raising false hopes and would divert scarce resources from more effective solutions to the very real problem of asthma.

What's more, the proposed standard would increase health and welfare risks from ultraviolet radiation, yet this was not considered in developing the proposal. Ground level ozone has the same beneficial screening effects on ultraviolet radiation as stratospheric ozone.

Based on EPA analysis used to support earlier rulemakings on stratospheric ozone, it appears that the proposed standard could increase the incidence of cataracts, skin cancers and melanoma fatalities. These negative effects appear to outweigh the positive health effects that EPA has attributed to the rule.

Using EPA's data assumptions and model results, I quantified and valued the health effects from the increased penetration of ultraviolet radiation attributable to this rule. My analysis suggests that attainment of the proposed standard would actually increase health risks by over $280 million a year. That is net of the benefits that EPA attributes to the rule.

When the costs of the proposal are considered, the negative impact on public health is even larger. A growing literature linking income and mortality suggests that the cost of this proposal would, by lowering incomes alone, induce more fatalities. That's something that I think Senator Sessions addressed in his opening remarks.

In fact, if as recent studies suggest, poverty is a more important risk factor than air quality for asthma, the rule may well increase the very disease it is targeted at improving.

Thank you. I'd be happy to answer questions.

Senator INHOFE. Thank you, Ms. Dudley.

Dr. Carl Shy.

STATEMENT OF DR. CARL M. SHY, DEPARTMENT OF EPIDEMIOLOGY, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

Dr. SHY. Thank you, Senator Inhofe.

I was very pleased to see that I was placed on the right side of this table from the point of view of the audience. I think we're also on the right side of the argument as far as public health is concerned.

I'm a physician and an epidemiologist. I've been involved in air pollution research for 30 years. I started my career with the Environmental Protection Agency and then moved to the University of North Carolina some 25 years ago.

I was recently a member of the panel on Particulate Matter of EPA's Clean Air Science Advisory Committee and I'm here to support the proposal to establish a new standard for fine particulates.

I agree with EPA's proposal that the $PM_{2.5}$ standard be established at a concentration of 15 μg per cubic meter annual average. I think there are three compelling reasons for EPA to establish an air quality standard for $PM_{2.5}$ as proposed.

The first reason is that I see and I think CASAC has also seen that there's ample evidence for a causal relationship between population exposure to fine particles and effects on mortality and morbidity in the population. There is ample evidence for excess mortality, for excess hospital admissions, for excess respiratory symptoms in adults and children and for decreases in lung function in children associated with currently experienced levels of particulate air pollution.

The second reason is that given this causal relationship, the health burden of exposure to particulates in the United States today consists of thousands of excess deaths, hospital admissions, and respiratory disease episodes.

These excesses can be addressed by a concerted program to lower the concentration of ambient air particulates. This program will bring a major health benefit for a majority of the U.S. population.

The third reason I think there is compelling reasons to support EPA's proposed standard is that the Clean Air Act requires the Administrator of EPA to establish a national ambient air quality standard that avoids unacceptable risks and protects public health with a margin of safety.

The risks that I've mentioned of thousands of deaths and hospital admissions I think are unacceptable and I think everyone would agree on that.

The proposed $PM_{2.5}$ standard that EPA has really provides only a minimal acceptable margin of safety against the mortality and morbidity risks that we have observed. We've seen excess mortality and morbidity when $PM_{2.5}$ concentrations are no more than 10 percent above the proposed EPA standard of 15 mg per cubic meter.

So even though the proposed standard may not actually be adequate, I think it will at least move our country in the right direction of greatly minimizing the currently unacceptable health burden.

The rationale for saying that there is a causal relationship I think was very well spelled out in the air quality criteria document of EPA to which CASAC agreed and the members of CASAC included epidemiologists who had a great deal of experience in the health effects of air pollution, including Frank Speizer, Jonathan Samet, Mort Lippmann, my colleague here, and myself.

I think that in contrast to the other persons mentioned earlier who did not agree with causality, the persons who have had a great deal of experience in epidemiologic studies of air pollution have agreed that there is a causal relationship established between particulate exposures and excess mortality and morbidity.

Thank you, Senator Inhofe.

Senator INHOFE. Thank you, Dr. Shy.

We've been joined by Senator Lieberman and I'd like to ask if he, at this time, in introducing his daughter, would like to make any statement?

Senator LIEBERMAN. Thank you, Mr. Chairman. You anticipated my most significant announcement which is to express my pride in

having my daughter, Hanna Rachel, with me. Would you stand briefly? Thank you.

[Applause.]

Senator LIEBERMAN. Undoubtedly, a future Senator from the State of Connecticut. I won't say yet which party because you know how children are.

Senator INHOFE. I'll work on her.

[Laughter.]

Senator LIEBERMAN. I apologize for being late. I don't want to interrupt the flow of the hearing and when it's time for questions, I'll be glad to join in.

Thank you.

Senator INHOFE. Thank you, Senator.

We'll now hear from Dr. Morton Lippmann who I think has become a regular around here.

STATEMENT OF DR. MORTON LIPPMANN, INSTITUTE OF ENVIRONMENTAL MEDICINE, NEW YORK UNIVERSITY

Dr. LIPPMANN. Not my own choice, but I am responsive to the will of the Congress.

Dr. Shy, with whom I served with on the CASAC PM Panel, has clearly covered the high points of the necessity for a fine particle standard. I was asked today to talk about the ozone issue and the risk assessment for ozone.

In the case of ozone, we understand some of the mechanisms very well and we have a huge body of clinical data which establishes some reversible but potentially important effects. So the problem there is the significance of small changes in lung function has been questioned as a basis for tighter control.

I point out in my testimony that the field studies of ozone responses in people engaged in natural activities outdoors that I pioneered in my own laboratory document clearly that the chamber responses are a minimum response, and that for whatever reason, we can't fully explain, per unit of ozone people in natural settings have greater functional responses and that establishes a baseline but not the full risk associated with the acute responses.

In our most recent paper published in February, we looked at asthmatic children and found physician-prescribed medication, as well as functional changes that would have to be considered adverse for this population.

There has been a lot of attention to the hospital admission studies and certainly ozone is not considered a causal factor but many people have asthma and it does aggravate it. I call your attention to page 5 of my prepared remarks which show the pyramid of responses associated with ozone from a wealth of environmental and epidemiologic data.

The EPA only took hospital admissions for asthma into account. There are equal numbers of nonasthma respiratory admissions. There is mortality and there's been a flood of new peer review data since the document was prepared, at least eight papers I've collected, that show greater associations with mortality and ozone, plus the hundreds of thousands of restricted activity days and asthma attacks which are documented in that chart. So I think the

Agency did not fully explain the serious health effects associated with ozone.

The pyramid also shows the coherence of responses. This is the progression of increased numbers with decreasing seriousness that one would expect if something real is happening.

There are some very important effects that are poorly understood which are not covered in the document, primarily because of the absence of data. The evidence clearly indicates that the lungs age more rapidly, that they become stiffer. We are probably talking about reduced longevity, although that is speculative at this time. That's a margin of safety consideration which the Administrator is obligated, by law, to consider in dealing with evidence primarily only on the acute effects.

I think it's important to reiterate that with all its limitations, this criteria document, the staff paper for ozone, are by far, in my opinion, the best that EPA has ever produced. They're more interpretative, they take all the evidence into consideration in a better way, and I can speak for experience since I've sat on every PM and ozone panel since 1980 that EPA has gone through.

In the end, there are uncertainties and if we're going to be more efficient in addressing the ozone issue, we need to engage in research based on the questions that have become better focused and sharpened through this review cycle.

I won't reiterate my previous written testimony responses to your earlier questions and so forth about the level of research that's needed, but ozone and particles are strongly interrelated and I note in my testimony this time that there will be benefits from controlling ozone that go beyond the effects of ozone alone.

When ozone is formed, fine particles are formed. The presence of the oxidants in that mixture oxidizes SO_2 and NO_2 to form more fine particles. So by controlling ozone, we would be substantially reducing the presence and impact of the fine particles which Dr. Shy has been talking about. So some of those benefits EPA did not claim I think are legitimate claims for the reduction of ozone.

I thank you.

Senator INHOFE. Thank you, Dr. Lippmann.

Dr. Alan Krupnick.

STATEMENT OF ALAN KRUPNICK, SENIOR FELLOW, RESOURCES FOR THE FUTURE

Dr. KRUPNICK. Thank you for inviting me to the hearing.

I wanted to mention first that I was in the first Clinton administration on the Council of Economic Advisors and I chair EPA's Subcommittee on Ozone, PM and Regional Haze Implementation Programs but these comments are entirely my own.

First, I wanted to applaud the Republicans for their openmindedness in inviting me here because I have somewhat of a mixed message.

On PM, I favor a fine particle standard, but one less stringent than the Administrator has proposed. On ozone, I favor changing to an 8-hour standard but set at a level of stringency no more stringent than the current standard.

I wanted to address my remarks to just a few points that have been in the debate, both in the EPW and in the press.

The first is junk science as applied to PM. Of course there are major uncertainties with respect to the epidemiology, the toxicological mechanism and so on but nevertheless, I think the scientific record supporting a fine particle standard is actually more than adequate judging from the perspective of the information underlying previous NAAQS rulemaking efforts which, in my view, are pretty laughable compared to the amounts of information we have here.

I think the Administrator is being prudent in issuing a fine particle standard and as to those who would wait until uncertainties are resolved, I say the best way to gain a better understanding of this pollutant and its consequences is to issue a fine particle standard now and that will get the country's attention.

EPA needs to be mindful of the possibility of going in the wrong direction and needs to have a process that triggers speedy reopening of the NAAQS process and the SIPs to reverse direction if it looks like that is the way to go.

The second issue is science versus policy judgment. Administrator Browner came before you cloaked in science as a justification for the standards but as the CASAC said, science doesn't lead to a bright line for either ozone or PM. There are no thresholds.

I feel for the Administrator that the Clean Air Act is not really giving her criteria for making a judgment, so she has to use her own. With respect to ozone, I think they are making the wrong judgment, the ozone effects seem to be very small of a tighter standard, the costs are likely to be huge, and their risk assessment is highly flawed.

In terms of backyard barbecues, industries use this analogy to dramatize the potential for invasive controls on everyday living and I have to agree with the analogy. In fact, one way or another, emissions coming from consumer sector activity will need to be controlled. Driving is going to be more expensive, inspection and maintenance programs are likely to have to go into new nonattainment areas. These are the areas where there are large emissions and they have to be addressed.

We've heard from EPA that the cost estimates for industries are usually higher than they turn out to be, the industries' own estimates, but using EPA's own estimates, you find the cost of going partway to meeting the ozone standard will be $2.6 billion and partway to the fine particle standard will be $6 billion. This is only a little of the way down the path.

Chicago, EPA finds, only can get 14 percent of the reductions it needs in trying to meet the new standard. The Northeast, for PM, only can get 16 percent of their reductions. There might be innovation and economic incentives that will hold down costs, but we're looking at much larger costs than EPA has written about.

I wanted to agree with Susan Dudley on UVB risks. EPA refuses to look at these and they are a major issue.

On the benefits of fine particles, we've heard that these are large dollar benefits based on valuing reduced mortality risks.

From the work that I've done, I find this is based on a body count approach to risk assessment. It doesn't recognize that most of the effects are to older people with compromised health, really

affecting the life expectancy of older people and by a very tiny amount.

Using values that older people provide for increasing their life expectancy a tiny amount, as well as those from younger people who provide this information from reducing their future life expectancies, has the potential to dramatically lower these benefits.

Finally, I've got to come back to Congress to say I think you should really fix the outdated criteria in the Clean Air Act for setting standards. Require that the Administrator consider benefits and costs of her actions, but of course consider this along with other criteria such as public health protection and equity and ethics.

If we're going to appropriately allocate our resources, we simply have to have the Administrator considering the social benefits of her actions.

Senator INHOFE. Thank you, Mr. Krupnick.

We're going to proceed now and we're going to try to adhere to the same confinements that we've imposed upon you.

Ms. Dudley, in your testimony you raised the issue of negative health effect and that was also referred to by Mr. Krupnick. You based your information on EPA data. You said they did not consider this in the proposal. Is that true?

Ms. DUDLEY. Yes, that's true.

Senator INHOFE. So the agency didn't factor these health costs into their benefit calculations?

Ms. DUDLEY. That's right. There's a paragraph in the RIA that says they expect the UV–B effects will be small.

Senator INHOFE. It's my understanding that the EPA was briefed on the health costs by the Department of Energy and I have the statement from the Department of Energy which I do want to submit to the record at this point because this actually makes comments on things far more serious than just UV radiation. They talk about HIV patients, skin cancers, cataracts and many other things there also.

While we talked about decreasing ozone and the benefits, we didn't talk about the liabilities that go with that?

Ms. DUDLEY. Exactly.

Senator INHOFE. Mr. Starr, I'd like to focus on one statement you made in your testimony which I addressed in my opening statement which leads to my main concern with the risk analysis for PM and that's the uncertainty with the science leading to uncertainty with the risk.

You said "Although there is not a proven causal relationship between the health effects and PM, the EPA had to assume a causation in order to calculate the expected benefits." How does this assumption throw off the benefits projections?

Dr. STARR. Senator, I think the important issue there is there is a certain probability that a causal relationship does not exist and if it does not exist, then implementation of standards may have, in fact, zero benefit.

Also important is to consider that those benefits were calculated with essentially a straight line type relationship between exposure level and response. Ironically, because most of the days of the year are characterized by low or moderate levels of particulate matter,

the projected benefits arise primarily from those days and not the days with high level exposure to particulate matter.

That is the area where the relationship, if there is one, is most uncertain. We do not know if there is an association and particularly—specifically we do not know what the nature of it is at these relatively low and moderate levels of PM.

Senator INHOFE. Dr. Chilton, in your testimony you stated, "The upper bound benefit estimate of $1.5 billion in EPA's analysis for ozone results from the assumption that the proposed standard would save lives and that this claim is unsubstantiated." I think that's very significant. I'd like to ask you to elaborate on that.

Dr. CHILTON. That's where I guess Dr. Lippmann and I would disagree. I don't think any of the studies he's talking about that try to show premature mortality relate to the kind of exposure levels that we're experiencing in this country. Nowhere else in the discussion is EPA talking about mortality effects of ozone except in the regulatory impact analysis. Then, to estimate the high end of the benefits, they take into account mortality effects. It's inconsistent, if nothing else.

Senator INHOFE. Would you say that fine particles don't cause deaths?

Dr. CHILTON. This is ozone we're referring to here, I believe. No, with fine particles, I just say the case is out on their effects. The science isn't sufficient enough to warrant setting a standard at this time. I don't share Dr. Krupnick's optimism that if we launch into this brave new world that it will all come out in the end. I'm afraid we'll do a lot and it may not have any effect whatsoever, but it will be costly.

Senator INHOFE. Do you want to respond to that?

Dr. KRUPNICK. Just a little. It's not all that brave. We already are controlling sulfur dioxide which would reduce sulfate levels which is counted as a fine particle. As Dr. Lippmann said, we are already reducing nitrogen dioxides which also convert to fine particles.

One issue I'd want to take up with Dr. Lippmann and mention to the committee is if we did not go further on ozone, we would not have to go as hard after volatile organic compounds, VOCs, as we would do if we tighten the ozone standard. I think that would save the country a lot of money for very little health risk.

Senator INHOFE. In attempting to stay within my own time limitations, I'm going to jump to Dr. Shy. In your testimony, you state a proposed standard of 15 μg per cubic meter for PM provides "a minimal acceptable margin of safety." I would ask you how many other members of CASAC shared your view that 15 was minimally acceptable?

Dr. SHY. It's difficult to tell because quite a few of the members of CASAC didn't express a numerical number.

Senator INHOFE. How many expressed it? It's my understanding there were only two and those are the only two who are here today who agreed with that figure.

Dr. SHY. Yes. One thing you have to realize is that many of the members of CASAC were not health risk experts or epidemiologists.

Senator INHOFE. So of the 21 scientists, just the two of you had expertise in this area and were able to properly analyze this and come to this conclusion?

Dr. SHY. I wouldn't say we were able to properly analyze, I'd say we've had in-depth knowledge of the quantitative levels of health effects and exposure that many other members of CASAC did not.

Senator INHOFE. And the other 19 did not?

Dr. SHY. Right.

Senator INHOFE. Senator Lieberman.

Senator LIEBERMAN. Thank you, Mr. Chairman.

This gets to what for me is at the heart of what is happening here. As you know, Mr. Chairman, I've generally supported the proposed standards, although I'm still learning and have some questions that I want to have answered on the understanding that the basic two-tier system that was established in the Clean Air Act is a sensible one which is that first, we have the obligation to try to reach a judgment, or the Administrator does, as to what the health consequences to people are of polluted air, and then, in the implementation phase, the system allows for the practical considerations, including costs.

For instance, in Fairfield County, CT, the prevailing air quality standard, the county was given 17 years to come into compliance because of the difficulty of doing that. That, to me, represented a combination, to the best science can provide us, of the health standard and then allowing factors of practicality and cost benefit to be fed into on the second tier.

I regret that I will not be able to listen to the testimony of most of you but I've gone over the written testimony submitted that we had before. Although obviously it's hard for those of us who are nonscientists to appreciate this, there are many occasions when scientists don't quite agree on where truth is. I don't know that I'd say there is artistry in science, but it's not always a question of two and two equalling four.

Perhaps I should start with a broad question for any of you who would care to answer it, particularly those who are critics of these air quality standards as they've been proposed. Is your criticism that the science is bad or is your criticism that cost benefit doesn't justify the standards?

If it's the latter, then my conclusion is that in the implementation phase, we'll take care of that, but if you disagree with that, I'd be interested in hearing why. Dr. Chilton.

Dr. CHILTON. I would like to comment on that. I do have a fundamental problem with the two-tiered approach. Absolutely, we need good scientific information, but I do not understand why we have proscribed having economic information. The strength of the economy has something to do with public health. It also has something to do with a lot of things that Americans value, as well as they value being protected from air pollutants.

I once suggested in an op-ed that we can create an Association for Compassionate Economists. It sounds like an oxymoron, but economists are some of the few people looking at the issue and saying that we need to look at benefits and costs. We need to make sure that benefits outweigh costs. Incremental spending on one program must provide more benefits than cost, otherwise we're wast-

ing resources. Those wasted resources even could be health-related resources.

Senator LIEBERMAN. But why do that at the same level? In other words, it's hard to do it with an operation but maybe if you went to your doctor and he gave you his best guidance about a condition you had and let's assume for a moment it's not life-threatening, and told you how much it would cost over your coverage, wouldn't you first want to know what the threat to your health is and then afterward decide whether you can afford to fix it?

Maybe a less frightening analogy is some repair to your house which somebody who should know is telling you what you ought to do, but then you're going to decide as we do all the time whether you can afford it at that given moment or not. At least you want the first stage to be as close to the fact regarding risk as somebody can give it to you.

Dr. CHILTON. The problem is, though, that at the end of the first stage, we've already made the decision. You're already going to incur costs. It's just a question of whether you're going to incur less cost because you do things a little more intelligently. You've already made the decision.

I often use the example of buying a car. Would you want to buy a Mercedes or a Chevrolet if all you cared about was quality? Well, you'd decide on the Mercedes. Then you can shop for friendly loan arrangements to try to reduce the payments for that Mercedes. If you looked at both quality and cost, you would have probably said, "My budget won't afford a Mercedes, and I'm going to go with the Chevrolet."

Senator LIEBERMAN. For me, that's essentially different because there is no particular risk whether you're buying a Chevrolet or a Mercedes, but there is the home improvement fellow who tells you your roof is about to fall in or if the doctor tells you that you've got a health problem and the question is how do you begin to treat it, do you do the more expensive or the less expensive. Ms. Dudley.

Ms. DUDLEY. I don't want to take up all your time but I looked only at the ozone rule and I think the rule is actually increasing health risks.

Senator LIEBERMAN. Because of the connection to the ultraviolet radiation?

Ms. DUDLEY. The ultraviolet radiation and also the notion that if asthma is our concern, there are so many other ways we can address asthma and make people with asthma have better lives that are better than this rule.

Senator LIEBERMAN. Without telling kids they've got to go inside?

Ms. DUDLEY. Right. I think more research on what is causing asthma is going to help a lot more children than this rule.

Senator LIEBERMAN. I was puzzled by that business about the ultraviolet radiation. Forgive me, I'm giving an extreme rendering of it but it almost sounds like the more ground level ozone we have, the better it's going to be for us because it's going to protect us from ultraviolet radiation. That can't be what you're asking because we know at some level people get sick from ground level ozone.

My lay reaction to what you said is that you were mixing apples and oranges here, that 95 percent of the atmosphere is ozone and

way up 30 miles above our heads. The ground level ozone is only about 3 to 5 percent of the total and that's what we're focused on here.

Ms. DUDLEY. That's true. It's a real tradeoff though. These are real health risks, these cataracts, skin cancers, and deaths.

Senator LIEBERMAN. Sure.

Ms. DUDLEY. They are just as real as the health risks from ozone. Some might even say more real. All I'm saying is that a policymaker needs to have that information.

Senator LIEBERMAN. This is my last question because the red light is on but aren't we taking care. Presumably we continue to implement the CFC prohibitions. Aren't we taking care of the stratospheric ozone level in a way that doesn't require more ground level ozone to protect us from UV radiation?

Ms. DUDLEY. I guess that's a decision that policymakers should make, but it shouldn't be hidden. It should be explicitly addressed because it is a very real tradeoff.

Senator LIEBERMAN. Thanks, Mr. Chairman. I'm sorry I went over.

Senator INHOFE. Senator Hutchinson.

Senator HUTCHINSON. Thank you, Mr. Chairman.

Ms. Dudley said, I think at one point in her testimony, that it would take at least a decade for implementation of these. In the hearing we had with Carol Browner, I outlined a time line which I think wasn't unreasonable in implementing the PM standard. Recently at a meeting with EPA, it was suggested that monitoring should begin as early as January 1998.

Since EPA clearly didn't have the money to establish the monitoring outposts that would be necessary, the question was asked, where will the money come from to buy the new monitors? I think there are 51 on PM, 51 monitors nationwide, so where do we get the money to do that?

EPA's answer was that it was expected that States have already begun to budget money to purchase monitors in preparation of the implementation to standard. So yesterday, we talked with the Arkansas Department of Pollution Control and Ecology to see if EPA's assertion was correct in Arkansas. Has Arkansas begun to budget money to purchase monitors? The response was about what I expected. They laughed.

In Arkansas, they budget every 2 years. We just finished the budget cycle about a week ago. The next budget process will not begin until 1998, will not be finalized until March 1999. No new money would be available until at least July 1999.

I don't know what the other State budget processes are like but I suspect they are similar which means the money available to purchase these monitors for a regulation that is not even being promulgated is a long ways from being there. So at least in Arkansas, monitoring probably could not be possible until sometime in the year 2000 at the earliest.

If you assume a 3-year monitoring period, a year of technical analysis, State implementation plan proposals, et cetera, we're looking at the actual control of particulates sometime well into the next century, maybe even as late as 2006, 9 years away or a decade, is about what Ms. Dudley said.

Dr. Krupnick, you may be right, it may be worth going ahead and doing this to get the country's attention, but I think surely there is a better way.

My question is given the conflicting scientific evidence that we have, and I think Dr. Lippmann said there are uncertainties, at least in the ozone area, wouldn't it be just as productive to do the research on the issue for a few years to determine the best route to take on regulating PM and really get an answer to that question?

Dr. Lippmann, it's my understanding at a recent House hearing on the standards, you testified that if given a choice between implementing the PM standards now or waiting 5 years and getting $50 million a year for research on particulate matter, you'd rather have the money for research and that makes sense to me. It would seem to me that would be the best use of very limited resources.

Dr. LIPPMANN. No, that is not correct. I don't think you'll find it in the record. There was a hypothetical question by one member that stated, couldn't some of the same objectives be obtained by targeting, monitoring and research money as implementing the standard.

In the particular context of the question asked, I said, much of the objective could be achieved, but I do not endorse delaying the standard. I think without the standard, we won't have the monitoring data.

Monitoring data is useful for legal enforcement and in the initial case, as you suggest, for finding out whether enforcement will be needed, but in this field where we're looking at population responses, and for PM, that's what is driving it, human responses based on comparison of health responses to ambient levels. Only the existence of the standard will get that monitoring network in.

I think I'd like to respond to what you just said in terms of the dollars. I participated in the CASAC Panel on the design of the monitoring system. EPA was very concerned about the cost of the system and I think they went a little too far in making it inexpensive.

I think it might be better to invest a little more in monitoring and get more frequent and better data, so the monitoring equipment is not expensive. Arkansas or any other State does not need a separate budget. The budget of the agency which is now monitoring will not be greatly stretched by buying a few of these monitors. That's a false issue.

Arkansas and the other States may have no choice, if monitoring is required, they're going to have to do it and they are going to have to find a few thousand dollars to buy a monitor. That's not an issue.

We may, in fact, not enforce these rules until the next century but if we don't start now, we'll never start.

Senator HUTCHINSON. Except that we may be imposing the wrong rules and not have the research.

Dr. LIPPMANN. Clearly that is not the case now.

Senator HUTCHINSON. I know that is your opinion but we heard lots of testimony over the preceding hearings that there is a lot of conflicting opinion and clearly, it is a policy decision that is being made. It may be the case that our biases are imposing our policy

view on this, but it's not just science. There certainly is a differing opinion among the scientists who have testified.

Mr. Starr, you said in your opinion, there would be zero benefit with the new standards. Ms. Dudley, you said—and this was kind of startling—your assertion that in fact the new standards would negatively impact health risks. I guess that's the UV. I think Mr. Krupnick said in fact he didn't think EPA adequately addressed those concerns.

Dr. Shy, what is the answer to that? Why has that issue not been dealt with, the possible negative health risks that could be the result of these standards?

Dr. SHY. I think many of them are claiming that ground level ozone is somehow going to protect us against ultraviolet light. It is really stratospheric ozone that is important, not ground level ozone. That point was made by Senator Lieberman.

Senator HUTCHINSON. Indeed, he did. Ms. Dudley, could you respond to that?

Ms. DUDLEY. EPA's analysis, if you look into it, indicates that it is total column ozone that matters, and ground level and stratospheric ozone both have the same impact on total column ozone.

Senator HUTCHINSON. I know my time is up but Mr. Krupnick would you comment on this line?

Dr. KRUPNICK. I have to agree there. Although there is only 3 percent of the total ozone column which is low level, these ozone benefits that we're talking about from tightening the standard are so small that they can be overwhelmed or maybe nearly overwhelmed by the small increment.

Senator HUTCHINSON. Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Hutchinson.

We're a little bit ahead of schedule so while we're not going to have a second round, I want to ask if any of the members remaining would like to ask one additional question. We can do it and try to keep it down to about 2½ minutes.

Before you came in, Senator Lieberman, we talked about what was going on over there and why we had to make sure to stay on schedule, so we can get back to our meeting.

Dr. Krupnick, you support the PM proposal except you would apply cost factors and set the standard higher at 20 micrograms, is that correct?

Dr. KRUPNICK. That's right.

Senator INHOFE. You agree that we don't completely understand the mechanisms or which of the particles is the culprit, correct?

Dr. KRUPNICK. Right. I say this this way just because to me the epidemiological literature on PM does tell a compelling story, a coherent story. There are lots of uncertainties, but again, as I said in my testimony, if you go back to when the ozone standard was set in 1977 or 1978, a handful of studies, incredibly primitive techniques, very little information, total policy call on the Administration's part.

Senator INHOFE. OK, but I guess what I'm trying to get at also is you'd said Congress should bind the EPA in the event the evidence came along, they could fast track some legislation. If that should happen, would that reopen the Clean Air Act?

Dr. KRUPNICK. I think there could be agreements made with EPA to develop a fast track process. You'd have to ask your lawyers about that, but there should be some fail safe measures put in so that we can reopen the NAAQS process quickly.

Senator INHOFE. Last, on ozone, you mentioned the importance of selecting the appropriate number of exceedances. The EPA has chosen three and I recall you were here during our first scientific meeting. I remember Dr. Schwartz was saying the standards are much more stringent over in Europe. However, we found out in Europe, they are not 3, but 10 and that's in a period of 1 year instead of 3 years. Would you comment on how this would affect the U.S. standard and how the EPA should determine an appropriate number?

Dr. KRUPNICK. This sounds like it's not an important issue, when you say three or four or five or six exceedances, but in fact, because the distribution of daily readings of ozone is so skewed, just increasing that number of exceedances from three to five could result in 200 fewer counties being in violation. So this is an extremely important decision and one the Clean Air Act criteria doesn't give the Administrator really any guidance on.

Senator INHOFE. That's the point I'm making on this.

Senator Lieberman.

Senator LIEBERMAN. Thanks, Mr. Chairman. I appreciate the opportunity to ask one more question.

This goes to the basic two-tier system and the standards set in the first tier. Dr. Chilton, I didn't have a chance to hear you but I gather you spoke to an issue that I read in a Providence Journal article you'd written the lend of last year which was to recommend "EPA should shift from the old paradigm of protecting the public health with an adequate margin of safety to a new paradigm protecting the public against unreasonable risk of important adverse health effects."

In the context of the scientific uncertainty, it has been my conclusion that we ought to stick with the current standard which is protecting the public health with an adequate margin of safety and then fit in the practicality, including cost in the second tier.

I worry in the recommended new standard that you've proposed that there's a lot of words there that are not scientific, in other words, for instance, unreasonable risk with the emphasis on unreasonable which is a tough word to define, and not only adverse health effects which EPA has been protecting us against with an adequate margin of safety, but important adverse health effects again, leaving some question about definition.

Maybe I'd first ask Dr. Lippmann and then ask you to respond, based on your own experience on CASAC, how do you respond to Dr. Chilton's proposed change from the adequate margin of safety in terms of health to unreasonable risk of important adverse health effects and then I'd ask Dr. Chilton to respond?

Dr. LIPPMANN. I think Dr. Chilton's language allows anybody to come to any conclusion they want. I think we've lived with the Clean Air Act language for many years and it has led to very great improvements in air quality and improvements in public health as a result of the reduction of air pollutants.

Senator LIEBERMAN. Am I not correct that EPA sets the standards not to protect against all identifiable effects but only against those that are adverse?

Dr. LIPPMANN. That's correct and that's where the ozone effect on lung function comes in. It can easily measure small changes in capacity but we have trouble interpreting it as being adverse until it reaches a certain magnitude. So I think judgment will always be necessary, but I think as long as we choose to give great emphasis to the public health and look at populations at risk, not extreme individuals at risk as the EPA currently has been doing, I think the current rules are quite reasonable.

In fact, in recent examinations of acceptable ozone levels, the trend is well below those proposed by EPA. The World Health Organization in Europe has just adopted a 60 or .06 ppm recommendation for ozone based on 8-hour exposure, not .08.

In fact, the occupational health limit for workers who are adults and healthy enough to work is now .08 for moderate work and .05 for heavy work. So we're not talking about extreme degrees of protection; we're talking about only protecting to the level that healthy workers are being protected currently.

Senator LIEBERMAN. Dr. Chilton.

Dr. CHILTON. I'd like to respond to your question. I think we're stuck with the problem of words being ambiguous. I don't think we can define "public health" with no ambiguity. I don't believe we can define "adequate margin of safety" with no ambiguity.

In point of fact, CASAC has said in its closure letter that the current paradigm is impossible. It will not work because we can find effects all the way down to background levels. So there is no adequate margin of safety possible.

I don't know how you ignore that conclusion. I agree with that conclusion. I concluded that a long time ago and I was really thrilled to see that in print.

The point of trying to go to an objective that prevents important adverse health effects and unnecessary exposures is that it gets around a problem that Milton Russell, a former EPA official, once described. Dr. Russell said that the Clean Air Act, the way it is currently written, protects against the effects of a common cold and cancer as if they were both the same and as many resources should be spent on the one as should be spent on the other.

I think that is a fundamental flaw of the Clean Air Act. There is no differentiation of what is a significant public health effect. The interpretation of "adverse" is set at a very low level. If some small group of sensitive individuals are affected, that's an adverse effect. Whether it's reversible or not doesn't matter; whether it's lethal or something that is an acute effect is not taken into account either.

Senator LIEBERMAN. Thank you, Dr. Chilton. I understand your position but respectfully, I disagree with it because I'd prefer it to err on the side of the adequate margin of safety as opposed to opening up the doors of unreasonable risk of important adverse health effects. It's been a good exchange.

Thanks, Mr. Chairman.

Senator INHOFE. Thank you, Senator.

I have one more question for clarification. Senator Hutchinson made a comment, Dr. Lippmann, and asked the question about going forward with the agency's PM proposal or in lieu of that, spending $50 million a year for 5 years on PM research and was implying that your position at that time was you would support that. You said that's not correct.

I'd asked for the transcript of the meeting and I'll just read this for what it's worth because I think it is a little bit confusing.

Representative Barton said, "I think she's saying we would do the measurements, we would appropriate the money to do the measurements; we just wouldn't set a standard. I think that's what she said."

Representative Cubin, "Exactly. That's exactly what I said."

Representative Barton, "So would you oppose that?"

Dr. LIPPMANN. "No. If in fact the situation were created where we were getting this information and the pressure is under the current Act to get the levels further down, we could get away with that. I doubt if that's going to happen." Is this an inaccurate statement?

Dr. LIPPMANN. I stand by my earlier statement to you. It was a hypothetical and it wasn't inaccurate in the terms of responding to a hypothetical, but it's not my preferred position by any means.

Senator INHOFE. Then you can have it both ways.

Dr. LIPPMANN. If you interpret it that way.

Senator INHOFE. All right.

First of all, thank you very much all of you for coming. We appreciate it.

I see there are no further questions and we'll move on now for our second panel, the panel on implementation. Our second panel consists of, again, Alan Krupnick—we're going to wear him out—Resources for the Future; Mr. Paul Kerkhoven, manager of Environmental Affairs, American Highway Users Alliance; Mr. Ben Cooper, senior vice president, Printing Industries of America; Ms. Beverly Hartsock, deputy executive director, Texas Natural Resources Conservation Commission; Ms. Mary Nichols—we know her very well—assistant administrator, Office of Clean Air and Radiation, Environmental Protection Agency; and Ms. Patricia Leyden, deputy executive officer, Stationary Source Compliance, South Coast Air Quality Management District. Welcome to the panel.

Let's start off with Dr. Krupnick, again.

STATEMENT OF ALAN KRUPNICK, SENIOR FELLOW, RESOURCES FOR THE FUTURE—CONTINUED

Dr. KRUPNICK. I want to doubly emphasize here that I'm speaking from a position of experience as the co-chair of EPA's Federal Advisory Committee for Ozone, PM and Regional Haze Implementation Programs, but I am speaking for myself, not for what I'll call the FACA.

My main message to you is that the proposed standards, if they become law, are likely to be incredibly expensive to implement and our FACA is working toward developing consensus ideas to try to reduce those costs.

The Administrator has clearly endorsed cost effectiveness as a major criterion for developing an implementation strategy and I

think Congress' job is to help EPA live up to this goal and remove any impediments posed by the Clean Air Act.

For this testimony, I'm taking it as given that the proposed standards are going to become law and now I'm asking, how can we cost effectively get there.

Some background on FACA since I'm going first here. The EPA established this now 82-person subcommittee to obtain advice and recommendations from a broad group of stakeholders on possible new cost effective approaches to attaining the NAAQS and reducing the regional haze. We were charged with thinking out of the box and out of the Clean Air box as well, if that was appropriate.

The committee has reached few specific consensus recommendations and the subcommittee and associated work groups have been working, and also EPA staff, exceedingly hard and are making significant progress in identifying options, discussing the pros and cons of many critical issues, and deciding how to decide on which options are the best.

Our subcommittee will continue through 1997 with the goal of providing EPA with input and perhaps consensus recommendations on issues critical to the development of their implementation strategy.

We can't work miracles, it's a very large, diverse group. We get into a lot of tense arguments and I think the progress has been limited so far because the standards issue has not been settled. Once that issue is settled, I think negotiations are likely to become much more intense.

There are a number of measures that have come out of our FACA that have come up, although they are not agreed upon by any means yet, that I thought I'd bring to the attention of the committee for reducing the costs of meeting these standards.

No. 1, that I think does not require congressional action has to do with reasonable further progress reform. Serious consideration is being given to one, basing measures of progress on effective emissions which would account for the effect of a location of a source, its stack height and other factors rather than assuming that all tons are equal when the States go after emissions reductions under RFP.

No. 2, giving States the flexibility to define RFP that's appropriate for their particular conditions rather than one-size-fits-all, and No. 3, permitting States to take credit in the present for emissions reductions that would occur in the future, such as through land use controls.

Congress can do several things. The first is to affirm EPA's interpretation of the area classification section of Title I. This interpretation is that a change in the form and/or level of the ozone standard would invalidate this section. That affirmation is essential, I think, if the highly prescriptive and expensive mandates that are in the Act are to be able to be reexamined.

The second is, I'm afraid to say, to open the Clean Air Act. I think the Act significantly restricts EPA's ability to implement cost effective ideas without compromising environmental protection. Let me give you a few examples.

The first is facilitating the creation of a regional NAAQS trading program. In the FACA, if there is one thing we've agreed on, it's

regional air management partnerships, or RAMPs, that are regional planning institutions that could help develop a NAAQS trading program. My fear is that we need Federal involvement to get all the States to play by the same rules.

We need, I think, to eliminate LAER and BACT requirements, the tight technology requirements on new sources if there is a trading cap in place. We can't do that with the current Act.

Congress should make it clear that episodic use of controls to reduce ozone episodes are creditable toward reasonable further progress and for use in attainment demonstrations.

Although I'm sure Congress is reluctant, it should provide EPA with authority to require that States adopt specific cost effective policies and measures as part of their SIPs. This should come with a quid pro quo that EPA's requirements pass some sort of cost effectiveness test.

Finally, on the Clean Air Act, I think Title II and Title IV need to be reopened as well in light of these new standards. Both of them can inhibit the use of cost effective approaches to meeting the standards.

For instance, on the SO_2 Allowance Trading Program in Title IV, that has been pretty successful, but the cap may need to be tightened to meet these tighter, fine particle standards.

My last plea is one that's already come up which is for Congress to increase a target funding for monitoring and make it a line item in the EPA budget so it can't be raided for other uses.

Thank you.

Senator INHOFE. Thank you, Dr. Krupnick.

Ms. Mary Nichols, it's nice to have you back.

STATEMENT OF MARY NICHOLS, ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Ms. NICHOLS. Thank you, Mr. Chairman.

I'll try to summarize my testimony as well.

I'm delighted to be invited back this time to talk about the implementation efforts that are associated with the EPA's proposed revisions to the National Ambient Air Quality Standards for Particulate Matter and Ozone.

The history of the Clean Air Act over the past 26 years is one that we can all be proud of, that of working to make progress continually and bringing down the levels of air pollution and to do it at a time when our country has been growing both in population and in our level of domestic/economic activity.

The Clinton administration views protecting health and the environment as one of its highest priorities and we have prided ourselves on protecting the most vulnerable among us, especially children, from the harmful effects of pollution.

When it comes to the Clean Air Act, we take very seriously the responsibility that Congress gave us to set air quality standards that will protect public health with an adequate margin of safety, recognizing the difficulties in making those decisions based on the best science available.

As you well know, at this point, we have only proposed revisions to the standards for these two important pollutants. We are in the

process of very seriously considering all the public comments on these proposals before making any final decisions. We've heard from small businesses, industry, State and local governments, other Federal agencies, and citizens, including individuals who have various forms of lung diseases, doctors, and the public at large.

While we have proposed specific levels for each pollutant, we've also asked for comment on a wide range of alternative options. We do not intend to make a final decision until we've carefully considered comments on all of those alternative options.

Throughout the history of the Act, the national standards have been established based on an assessment of the science concerning the effects of air pollution on public health and welfare. Costs of meeting the standards and related impacts have never been considered in setting the national ambient air quality standards themselves and this has been true throughout six administrations and 14 Congresses and has been reviewed by the courts frequently. So we have a body of common law, if you will, on this topic.

In choosing our proposed levels for the ozone and particulate matter standards, EPA's focus has been entirely on health risk, exposure and damage to the environment. Sensitive populations such as children, the elderly and those with asthma deserve to be protected from the harmful effects of these pollutants and, I think almost equally importantly, the American public deserves to know whether the air in its cities and counties is safe or not.

That question ought not to be confused with the separate issues of how long it may take or how much it may cost to reduce pollution to safe levels. However, if we do revise any air quality standard, it is both appropriate and indeed necessary to work with States, local governments, and all other affected entities to develop the most cost effective, common sense strategies and programs possible to meet those new standards.

Under the Clean Air Act, States have the primary responsibility and discretion for devising and enforcing implementation plans to meet the national standards. We are determined to work with States and others to ensure a smooth transition from efforts to implement the current standards to any efforts that may be needed to implement new standards.

We haven't waited until the final decision to begin doing just that. By 1995, it had become apparent from the emerging body of science that we might have to propose revisions to one or both of these two standards, ozone and particulate, and that in order to fulfill our obligations to develop a regional haze program, new tools would be necessary.

At that time, we determined the best way to meet the goal of developing common sense implementation strategies was to bring in experts from around the Nation to provide us with their advice and insights. As a result, we've used the Federal Advisory Committee Act to establish a Subcommittee on Ozone, Particulate Matter and Regional Haze.

John Seitz, director of the Office of Air Quality, Planning and Standards in my office co-chairs that committee along with Dr. Krupnick who is here today. The subcommittee is composed of about 75 official representatives from State and local government,

industry, small business, environmental groups, and other agencies. It also includes five separate working groups with additional members composed of another 100 or so representatives of these or similar organizations.

The subcommittee and various groups have been meeting regularly for over 18 months to address strategies for EPA and the States to consider in implementing any revised standards. Indeed, much of their work will be useful to us even if EPA were to make the decision not to implement any revised standards because it's building on the work we're already doing today.

The members from the various groups are putting forward position papers with innovative ideas and it's our belief that many important discussions are taking place. Basically, there are five important questions this group is considering and I'll just tick them off.

One is the issue of deadlines. What should the deadlines be for meeting any new standards? Again, we assume there is an opportunity to either continue or to revise the system that was put in place in the 1990 amendments for dealing with various classifications of areas.

What should be the size of an area that's being defined as a nonattainment area? Again, if there are revisions to the standards, EPA has a responsibility to determine what areas are nonattainment and to draw the boundaries. We know how contentious those issues can be. We also know more than we did even at the time the 1990 amendments passed about the issue of transport.

That leads to the next issue which is how do we actually address, in a cost-effective manner, the problem that the pollutants that form ozone and fine particles are transported hundreds of miles and continue to operate in the atmosphere, to react in the atmosphere as they move into downwind areas.

What kinds of control strategies are most appropriate for the various nonattainment areas? Can we use the experience of the past several years to help the States target those control strategies that are the most effective.

Last, but obviously the most important of all, how can we promote market-based air pollution control strategies?

All of these kinds of issues relate to the basic reality that revision of the revised standards is going to need to focus on the major emitters. We're talking about cars, trucks, buses, power plants and fuels. Those are the major sources and tools that we have to work with.

In some areas, as with the current standards, we're seeing that reaching the standards will present substantial challenges. All the programs we're pursuing to meet the current standards for ozone and particulate matter will be needed to meet any new and revised standards as well.

Everything we're doing today will be helpful in meeting any tougher standards that may be adopted. For example, the sulfur dioxide reductions that are achieved in the acid rain programs will greatly reduce levels of fine particles in the eastern United States.

Senator INHOFE. Ms. Nichols, we're going to ask you to conclude your opening statement. You've run over the time.

Ms. NICHOLS. I will. Thank you, sir.

I'd just like to add that we've expanded the membership of the committee in order to include more small businesses as well as local governments in the interest of making sure that we have the widest possible participation and the Administrator has stated her intention to propose first steps in implementation at the time we announce our final decision on any revisions to the ozone and particulate standards.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Ms. Nichols.

We have been joined by Senator Baucus. Do you have an opening statement you'd like to make.

Senator BAUCUS. Not at this time.

Senator INHOFE. The next witness is Mr. Paul Kerkhoven.

STATEMENT OF PAUL C. KERKHOVEN, DIRECTOR, ENVIRONMENTAL AFFAIRS, AMERICAN HIGHWAY USERS ALLIANCE

Mr. KERKHOVEN. Good morning, Mr. Chairman.

Thank you for the opportunity to be here this morning.

The transportation sector has played a major role in attaining the air quality goals realized by many areas across the country. We expect this role to continue.

Carbon monoxide emissions from highway vehicles have been reduced by one-third, while VOC emissions have been cut in half. Today's cars have achieved at least a 95-percent reduction in tailpipe emissions since 1960 and it takes 20 of today's new cars to produce as much tailpipe pollution as only one car did 30 years ago.

The reformulated gasoline for California is so effective, it's like taking 3.5 million cars off the road. That's twice the number of vehicles registered in the State of Oregon.

In spite of these accomplishments and future progress, the EPA continues to advocate strict policies to control the growth of vehicle miles traveled. The agency pursues this misplaced policy by enforcing transportation control measures that discourage automobile use and advocate higher funding for the congestion mitigation and air quality programs to implement these measures.

Mr. Chairman, a fundamental individual freedom, the freedom of mobility, is at stake whenever the Government proposes to restrict the ability of Americans to choose where, when and how to travel. There may be times when such restrictions are necessary but those decisions should not be made by our elected representatives and not by the subterfuge of a bureaucratic rulemaking procedure. Constraints on motor vehicle use and restriction of personal mobility are a serious obstacle to economic growth and productivity increases.

One of the Clean Air Act's largest challenges are its conformity determination requirements. The conformity provisions were designed to ensure that transportation decisions made by State and local governments in areas out of compliance with air quality standards were consistent with the region's plan to improve the air. Failure to meet the conformity requirements by a State can lead to withholding of Federal highway funds.

The implementation policy for the proposal states that the present conformity determination process will continue until State

implementation plans that address the new standard are approved by the EPA.

We question whether the current model intensive conformity process will still be meaningful with much larger nonattainment areas. For example, to make a conformity determination in rural areas will be a senseless and cumbersome exercise because in virtually all cases, there are few, if any, transportation alternatives.

The proposal also will likely result in tighter emission budgets and make conformity an even more challenging process.

The proposals do not address the cost effectiveness of the transportation control measures and these may be the most costly elements of further emission reduction efforts. Similarly, the highway funding sanctions could also affect larger areas.

I question whether the EPA intends to impose highway funding sanctions on the 8–20 residual nonattainment areas in its partial attainment scenario. Transportation is a big part of the economic development equation. Projects to reduce congestion and expand capacity should be expedited, not burdened with new regulatory hoops.

Congress established the Congestion Mitigation and Air Quality Improvement Program, also known as CMAQ, in ISTEA primarily to help State and local governments meet the cost of implementing the transportation control measures. The Highway Users oppose setting aside $1 billion of highway funds each year exclusively to meet costs imposed on State and local governments by the Clean Air Act. Those air quality improvement projects may or may not be a top transportation priority in a given area.

The Highway Users support the efforts to eliminate separate CMAQ funding category and we question EPA's efforts to promote it. We would make air quality and congestion mitigation projects eligible for funding under a streamlined surface transportation program.

As for the assertion that State transportation officials will not implement transportation control measures in their plans, if they do not have the specific setaside for them, we do not believe that.

Mr. Chairman, the 1990 Clean Air Act mandates that State transportation officials give priority consideration to and provide for the timely implementation of transportation control measures in their clean air plans. It is not the CMAQ Program that drives these requirements.

If attainment goals are not reached, the State faces highway funding sanctions. There is no greater incentive. This is the stick that forces each State and local official to craft transportation plans which include the right mix of projects to reduce emissions.

The Administration's new highway bill also addresses the CMAQ issue and there are several provisions there that we support and do not support. We do not support the hold harmless provision for CMAQ funding, nor do we support the proposal that when a State submits its SIP, the CMAQ funding increase is triggered. Both provisions expand CMAQ funding at the expense of the more flexible STP account.

If Congress chooses to retain a separate CMAQ account, we do support the Administration's proposal to fund two transportation control measures that are listed in the Clean Air Act, but were ex-

cluded from CMAQ funding eligibility in ISTEA. In addition, congestion mitigation projects such as those that increase capacity for single occupant vehicles in ozone and carbon monoxide nonattainment areas should be eligible for CMAQ funds.

Mr. Chairman, in conclusion, our central points are as follows. Current and emerging technologies will ensure the continuing decline of mobile source emissions without the new air quality standards. We should not burden vast areas of the country with new regulatory hoops the proposed standards changes will create.

The transportation control measures needed to meet the new standard could cause significant economic hardship and I would like to echo comments of the U.S. Department of Transportation that it will require lifestyle changes by a significant part of the U.S. population.

Finally, the Clean Air Act gives transportation officials strong incentives to make air quality projects a top priority. We urge Congress to give those officials a truly flexible STP program account that will allow them to weigh all their transportation needs, including air quality improvements, when establishing funding priorities.

Thank you.

Senator INHOFE. Thank you, Mr. Kerkhoven.

Mr. Cooper.

STATEMENT OF BENJAMIN Y. COOPER, SENIOR VICE PRESIDENT, PRINTING INDUSTRIES OF AMERICA

Mr. COOPER. Thank you, Mr. Chairman.

We appreciate the opportunity to appear before you today. I'd like to ask that the comments we make also be submitted in behalf of the Small Business Legislative Council, a coalition of almost 100 trade associations of which I serve as chairman.

Senator INHOFE. Without objection.

Mr. COOPER. I would like to say in the beginning that I also serve as a member of the Clean Air Act Advisory Committee and have since its beginning. I'm also a member of the Subcommittee on the Implementation of the New Proposed Standards. I have recently been appointed to a small industry review team at EPA to evaluate the impact of the standards on small business and other small entities.

I'd like to say at the outset that while EPA has come under a lot of criticism in these standards and will probably continue to, I think it's fair to acknowledge that EPA, particularly recently, has done a great deal to reach out to the small business community and to try to bring us in. While we would like for this to have occurred earlier in the process, a great deal is being done now to bring us in more fully.

I think it is also important to note that EPA has probably the strongest small business ombudsman program of any Federal agency and oversees a very strong State technical assistance program in dealing with implementation issues in the Clean Air Act. I think it's fair to acknowledge the positive work the agency has done.

I'd also like to say from the outset that we wish the new standards would not be implemented. We don't feel they are necessary. Having said that, if the new standards are to be implemented,

there are some areas we think are fairly critical, particularly in dealing with small business.

First of all, we don't believe the Clean Air Act has been fully implemented and we don't think we have even begun to see the full positive effects of the implementation of the 1990 amendments.

I know in looking at it from just the printing industry alone, we still do not have standards for the industry that are applied nationwide. There are many areas, technological issues, affecting the printing industry that have not been addressed. This is true in a number of small business sectors.

Second, we're quite concerned about EPA's data base on which it calculates the emissions from various industries. This is another area where I have some sympathy with EPA. Frankly, the data base is flawed. The data base that calculates emissions from various industries is based on permits; those permits are those of large companies and industries such as ours.

The permits are not based on actual emissions, but in fact, based on potential emissions and companies are virtually forced under their hopes for growth of buying more emissions than they may actually have so that the data tends to skew the emissions information a little higher than it is.

As I mentioned, one of the big problems in a lot of small business industries is guidance isn't available to the States. While it may be nice to say that when you get down to the city or county level that these people are working very effectively with small business, as a practical matter, small business is treated as a group. It is sort of a regulatory carpet bombing.

The regulations are sort of laid out there, small business is told to reduce by 10 percent, but without the guidance necessary to tell them how to do it. What this amounts to, in effect, is not so much a reduction of emissions, but a collection of fees because each one of these permits comes with a permit fee. So for many small businesses, they look at this as simply an environmental tax rather than a program of actually reducing emissions.

We think the implementation plan that's under discussion may be superior to the current plan and we don't know, we haven't evaluated it fully, is going to be confusing to small business. As a native of Alabama, looking at this chart, if you're living in Gadsden, AL, you don't know which area of influence you're in and you don't know which area of violation you're contributing to. In fact, you could end up with jurisdictions giving you direction from different directions.

One of my main concerns in this program is that we have not even addressed in the implementation strategy something Carol Browner has put a great deal of her efforts into and that is multimedia applications or alternative strategies for dealing with overall pollution reduction.

We're one of the common sense initiative sectors at EPA. We think this clean air proposal ought to be run through those common sense sectors so that we can balance the media effects of different pollutants, not just air pollution.

EPA has a major program underway called ECOS which is dealing with this same type of project. We think it's a golden oppor-

tunity for EPA to change the method of operation in dealing with States.

Finally, from a very parochial standpoint, the small business program of the Clean Air Act, known as the 507 Program which we were instrumental in getting included in the amendments to the Act, has not been fully implemented.

If we go through with the implementation of this new standard without adequate guidance at the State level for small business, I'm concerned there will be chaos and I think we really need to address those very critical issues before we move ahead.

Thank you very much, Mr. Chairman.

Senator INHOFE. Thank you.

Ms. Leyden.

STATEMENT OF PATRICIA LEYDEN, DEPUTY EXECUTIVE OFFICER, SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Ms. LEYDEN. Thank you, Mr. Chairman.

I too will speak informally from my comments that you have.

I regulate all of the largest industries, many medium and small industries in the South Coast Air Basin, and I'd like to talk to you today about the issues of implementation with the new standards.

I think it is especially germane for the Senate to look at what types of sources will need to produce additional emission reductions, what kind of time will be allowed to meet those standards, and how can we accomplish these objectives at the lowest possible cost.

To that end, I'd like to tell you just a little bit about our mass emissions trading program called Reclaim and then tie the discussion of that program to the matter before you today, the consideration of the new standards.

Reclaim is the largest multi-industry, mass emissions reduction program in the United States. It covers nitric oxide and SOx emissions; it regulates over 330 of the largest polluters in the South Coast Air Basin. It covers industries as large and as diverse as refineries, power plants, aerospace, hotels, cement kilns, metal melting and down to small businesses like hotels and even amusement parks.

When our program went into effect in 1994, it replaced over 32 command and control rules. It gives businesses the opportunity to select the lowest cost alternative to achieve their emission reductions. We're very pleased that the program is a success and has exceeded our expectations.

In the first 3 years of the program, the actual emissions from the sources are a good one-third below their allocations. The cost in reducing those emissions is almost half of what had been anticipated under command and control regulations.

We have a vigorous trading market, a market that has exceeded our expectations, with over $33 million in trades already having occurred to support plant modifications and business expansion.

Reclaim works. It works in large part because it is dealing with fuel combustion sources. Industries under the program very carefully report the actual emissions from the facilities. I think this is important because careful monitoring and reporting makes the emission reduction credits a blue chip investment in the market.

It also is germane as the Senate considers the new standards because as you look at what works, and you look at how it applies to large, medium and small-sized emissions fuel combustion sources, I think that ties directly back to the new standards before you.

I've written a lot of very tough command and control rules in my career. I think for the sources that I've regulated, the trading programs really do offer a lower cost way to accomplish the objective.

In many parts of the country, the new standards will require companies to meet emission limits currently in place in California. As we've looked at the new standards, we believe the driving force for additional reductions will not come so much from the ozone standards, but from the small particulate standards.

We spent about 2 years and almost $1.5 million collecting small particulate data. It drives us to the conclusion that additional emission reductions will come primarily from fuel burning sources. We'll be looking for additional NAAQS reductions, probably up to about 35 percent more than what we've seen to date.

We think our largest sources have really done their fair share and as we look to who needs to come up with additional emission reductions, we'll be talking in large part, first, about fuel burning sources subject to Federal regulations—ships, trains, planes, interstate trucks, offroad construction and agricultural equipment.

We'll also be talking about sources that are considered small and in many instances, have protected status currently under the Clean Air Act. Emissions from sources like refrigerators, stoves, small internal combustion engines sound small but they aren't when you're talking about a huge metropolitan area. Today, in the South Coast Basin, emissions from small internal combustion engines, less than 50 horse power, exceed the emissions of the largest power plant in the basin.

A few conclusions quickly. South Coast Air District supports the new standards. We have but one request—additional time to accomplish the objective. Our deadline under the current standards is 2010. We believe additional years will be required to meet the new standards.

Second, trading programs work. Trading programs will be an important component in achieving the new standards. For our program to have been adopted, we needed the political commitment to clean up dirty air, we needed a strong partnership with business and the environmental community to develop the regulations. For the new standards to work, the same will be true.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Ms. Leyden.

Ms. Hartsock.

STATEMENT OF BEVERLY HARTSOCK, DEPUTY DIRECTOR, POLICY & REGULATORY DEVELOPMENT, TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Ms. HARTSOCK. Thank you, Mr. Chairman.

My name is Beverly Hartsock and I'm pleased to be here today representing the Texas Natural Resource Conservation Commission to address the issue of implementation of the proposed new air quality standards.

From a State regulator standpoint, I think it's important to recognize that just adopting a new standard does not result in improved air quality. Programs must be developed to implement it and that is what my agency is expected to do.

Implementation of any new air standard follows a series of steps. Monitoring data must be gathered to determine if an area meets the standard. For the new particulate matter standard, this will mean installing and operating new monitors. Even phasing these in over 3 years, as EPA has proposed, will cost Texas from $1.3 million next year up to almost $2 million in 2000. There will also be additional monitors needed for ozone and its precursors since we are likely to have new nonattainment areas and there is a need to know more about transport levels in rural areas.

Next, we must inventory the sources of emissions in each of these areas. New nonattainment area inventories will require us to examine industrial and business process information and estimate all population-based activities. Analysis of emissions and air quality data must then be performed using computer model simulations.

This is a major undertaking as can be seen by the 2-year effort and millions of dollars that have recently been spent in the OTAG process, studying four high ozone episodes in the Midwest, Northeast, and Atlanta.

The computer analysis will yield an estimate of the level of emission reduction predicted to solve the problem. This reduction occurs through implementation of new rules or program requirements developed by State and local agencies based upon available technology, cost effectiveness, and feasibility.

Traditionally, large industrial sources have been the focus of these controls, but more and more, we're having to focus on smaller, individual contributors such as small businesses and cars since collectively these are significant emissions sources.

Final decisions on new controls occur through a public participation process of meetings and hearings. The results, along with all the supporting analyses, are compiled as a State implementation plan which is submitted to EPA. Reductions actually occur as sources come into compliance with the new requirements from one to many years later depending upon the type of program.

States must continue to monitor air quality to measure actual improvement compared to the modeled predicted benefits. Additional controls must be implemented if air quality goals aren't meant.

In my written comments, I provided a more thorough discussion of the air quality planning process, the difficulties we have encountered, and the problems we see with implementing proposed new standards.

In summary, there are five points I would like to leave with you. First, my agency and the leadership of our State are on record as supporting the retention of both the existing ozone and particulate matter standards until the science to support any change is more definitive.

The recently released studies of health effects of ozone estimate fewer benefits from the proposed standard than previously thought.

The particulate matter studies have raised as many questions as they have provided answers.

Second, if new standards are adopted, extensive new work will be needed to implement them and it appears likely that there will be little additional funding from EPA. States do not need another unfunded mandate.

Additional requirements without adequate funding will take away from our ongoing effort to solve the more serious air pollution problems that have already been identified.

Third, we should explore ways for air pollution planning to be a part of a city's urban planning whether or not new standards are adopted that cause the city to be designated nonattainment. New approaches should build on voluntary action programs such as flexible attainment approaches and should provide incentives for early planning, expanded monitoring and early reductions.

Fourth, adequate time should be provided to allow areas to plan, implement controls and measure the results of those controls. The 5-year timeframes of the Clean Air Act allow for planning and implementation, but fail to allow time to monitor results or to build adequate data bases.

Our experience shows that 10 years is a more reasonable planning cycle and the more difficult air pollution problem areas will take two or more planning cycles. Mid course corrections should be included so that new information can be used to improve imprecise predictions of growth and emissions changes.

Finally, adequate time must be provided to allow major emission reducing trends such as those happening in the transportation sector to be significant contributors to attaining national air quality goals. In order for the country to be able to afford all that is likely to be required to meet all of our goals, we must allow time for market forces and technological development to minimize costs of accomplishing the reductions and spread those costs over time.

Thank you for the opportunity to present these comments.

Senator INHOFE. Thank you, Ms. Hartsock.

We'll start with Dr. Krupnick since he's been around the longest.

I notice and a lot of the people have testified on the previous panel and also on this panel, and others may have a comment about this too, you had mentioned the implementation, you identify areas of the Clean Air Act that need to be invalidated and you provided a laundry list.

To do that, I think we pretty much would conclude we would have to have a full scale rewriting of the Clean Air Act. Do you agree or disagree with that?

Dr. KRUPNICK. I'm not a lawyer, so I can't make that judgment. It just seems to me that there are certain aspects of this new world that we're looking at that are really up to Congress to address.

I think if Congress does not act, it's my estimation that EPA is willing to push that Act as far as they can push it to try to move toward cost-effective implementation policies, but you could help that process along a lot and save the country a lot of money by maybe some surgical strikes into the Act.

Senator INHOFE. I guess what I'm getting to is every time this comes up, I've asked myself the question, is it all that bad. There are some very positive things that could come out of a rewriting

such as cost-benefit analysis and some things I feel would be a very helpful part of it.

Ms. Hartsock, I was listening to you and you covered pretty much the cost but let's go back and kind of put this in a timeframe. First of all, in Texas, I assume you don't have 2.5 monitors in place?

Ms. HARTSOCK. No. We haven't had any in place. In the month of March, we just put the first six out.

Senator INHOFE. When could you start deploying? You've already started deploying the monitoring network, is that right?

Ms. HARTSOCK. Yes, sir, but that is only in one city, Houston, and we have several other major metropolitan areas where we need to get out monitoring. That's to be started over the next year.

Senator INHOFE. Let's assume that is right, then if the EPA is proposing the standard as a 3-year average, what year would you have that data?

Ms. HARTSOCK. It would be 3 years from the time we started. Our phase-in program is over 3 years, so the first areas, such as Houston, we would have 3 years of data 3 years from now. The last of the areas would be 6 years from now.

Senator INHOFE. So say by 1999, you'd have a lot of them out. In 3 years, it would be 2002. After you get the data, what steps are necessary to designate the nonattainment areas and how long would that take?

Ms. HARTSOCK. There is a formal process, but in essence, I believe it's within a year that we have to have the designations in and then EPA has another year.

Senator INHOFE. Then you have 3 years after that for your State implementation plan, so that would put us around 2006?

Ms. HARTSOCK. Yes, sir, from that last date that you had.

Senator INHOFE. All right. When would you have attained the standard, would it be 5 years after the designation which would bring us to about 2008?

Ms. HARTSOCK. By that time, I think we're looking at having the initial round of controls in place, but as I indicated in my comments, one of the things you have to do then is monitor what the air quality looks like after those controls are in place.

Senator INHOFE. And I understand they allow one extension of say up to 5 years. So we're talking about then perhaps the year 2013?

Ms. HARTSOCK. Yes, sir.

Senator INHOFE. Every time I look at this, it seems to me it makes sense to just go ahead and conduct the scientific tests first and then collect the data before we set the standard. Someone mentioned the other day it's kind of like instead of ready, aim, fire, it's ready, fire, aim. Do you agree with that analogy?

Ms. HARTSOCK. Yes, sir.

Senator INHOFE. You mentioned unfunded mandates and this is something I'm very sensitive to being a former mayor of a major city for three terms. Our major problem wasn't crime in the street, it was unfunded mandates, but we passed a law that was supposed to protect political subdivisions. You are a political subdivision, you're the State of Texas. Do you consider this an unfunded mandate?

Ms. HARTSOCK. Yes. We do not see that additional funding is going to be made available by EPA to handle the new costs that we'll be incurring.

Senator INHOFE. Mr. Cooper, Senator Sessions was here earlier for the previous panel. We're all supposed to be going over there for an executive session, so we're going to be hoping to get through in a timely fashion, but he was concerned also. He looked at that map and that is something that would concern someone who is from Alabama.

In your testimony, you state your industry disagrees with the emissions estimates of the agency and it's miscalculated for printers and your industry. You also mentioned how the reductions are generally targeted across the board.

Do you have any estimates or has the EPA estimated the burden on your industry for implementation purposes?

Mr. COOPER. There are some estimates on the emissions and I think in fairness to EPA, I think you'd be able to agree these estimates are the best they have to work with. We don't have the estimates of emissions in our industry and part of the problem is, the science of air emissions on an individual site, an individual company, talking about monitoring data, is basically how you calculate what goes on in a certain kind of operation. It is not an agreed to formula. So any kind of estimation of emissions is guess work.

Senator INHOFE. You mentioned in your testimony that you're on the advisory board, right?

Mr. COOPER. Yes, I am.

Senator INHOFE. And you have recommended changes. Is this one of the changes that you might be referring to?

Mr. COOPER. Yes. As Ms. Nichols mentioned, we now have a larger group of small business folks on there. We are now meeting as a separate group to come up with these recommendations as a larger group of small businesses and how EPA can make some adjustments in these calculations.

Senator INHOFE. Mr. Kerkhoven, I'm also concerned about the transportation end and we're going to be considering ISTEA, the Intermodal Transportation reauthorization and what does this map do to you when you look at this?

Initially, correct me if I'm wrong, you were making your estimates on those areas that would be the smaller, dark green dots in the middle before we produced this map that shows two more concentric circles?

Mr. KERKHOVEN. Correct. Senator, actually the NHS bill addresses part of the conformity determinations, where conformity determinations may be made in the nonattainment areas and if we're going to expand conformity determinations to areas of violation or areas of influence, it's going to make it very, very difficult for localities.

Senator INHOFE. It is my understanding, is it your understanding also, that these areas outside of the dark green specified area would not qualify for CMAQ funding?

Mr. KERKHOVEN. Correct.

Senator INHOFE. Senator Baucus.

Senator BAUCUS. Thank you, Mr. Chairman.

I'll start with you, Ms. Nichols. What is EPA doing about ozone transport either currently and/or under the new proposed regulations?

Ms. NICHOLS. Senator Baucus, the issue of transport has been around for many, many years and Congress actually gave EPA some authority directly to take action to make sure that States don't interfere with attainment or maintenance of areas downwind. The problem historically has been to get the data and to get action taken can be a very lengthy, time-consuming process.

In the 1990 amendments, Congress actually created an Ozone Transport Commission to cover the 13 New England, northeastern States as far south as Virginia and including the District of Columbia in recognition that we now know enough about how the air moves around that region so that it was important that region get together and plan and take some action as a group in order to achieve the most cost effective reductions and to enable some of the areas to be able to attain the standards.

As a result of the 1990 amendments and the need for attainment plans, EPA convened a much larger group of States beyond the ozone transport regions covering the entire area east of the Mississippi where we had evidence there was some degree of transport and interference. The States themselves took on the task through the environmental commissioners of the States to begin a planning process, to do a great deal of modeling and analysis to try to get a better handle on this issue.

We are expecting in June of this year that we will receive recommendations from the Ozone Transport Assessment Group as to which States they feel need to take action in order to solve this transport issue for ozone. That's all under the current ozone standard.

In looking at this map here which somewhat out of context looks like an amoeba, it reflects the kind of conversations that some of the experts in the Advisory Committee have been having about how to deal with this issue, that there is transport, that States have the primary responsibility but that there are some kinds of cost-effective measures, as Dr. Krupnick mentioned, particularly cap and trade programs that can be implemented on a broader level if the States agree to do it.

There may be, indeed, a necessity on the part of some States to be doing some kinds of controls to help out their downwind neighbors if they really are making a substantial contribution. So these kinds of lines are designed to help people think about where you would want to have regional partnerships and the States getting together to at least try to plan together and possibly agree on some control strategies.

There is no consensus, at this point, on any of this stuff but there is particularly no consensus on what the area of influence might have to do. It would be up to the States that we're in an area of influence if one of them gets established to decide for themselves what the measures would be.

Certainly an area of influence is not the same thing as a nonattainment area. A nonattainment area is an area where you actually have violations of the standard, so some of the concerns that Mr. Kerkhoven mentions I think are frankly off the mark.

Senator BAUCUS. What you're saying though is that there's room under the proposed standards, to cap or trade or work out various arrangements to deal with transport?

Ms. NICHOLS. Yes.

Senator BAUCUS. You still think that is possible?

Ms. NICHOLS. I think it's possible. It's difficult.

Senator BAUCUS. And probably even necessary?

Ms. NICHOLS. But it will be necessary if the transport issue is going to be solved, yes, sir.

Senator BAUCUS. A general question I had for anybody who has problems with these regulations or proposed regulations, first of all, PM_{10}, it's my understanding that CASAC, the independent scientific peer review committee decided overwhelmingly that a new standard should be set. It didn't say what the standard should be, but did say a standard should be set. I think the vote was 19–2.

I wonder if anyone has any problems with that or disagrees with that conclusion of CASAC and why?

[No response.]

Senator BAUCUS. So everyone agrees a new standard should be set?

Ms. HARTSOCK. I don't know that I can speak for the others. I wouldn't indicate that I'm an expert on the standard in any way. The primary focus of the comments we had would be if there is going to be a new standard, what would be the steps necessary in implementation and what do we see as the problems there. I don't know that I'm really prepared to answer that.

Senator BAUCUS. CASAC did say, especially with respect to $PM_{2.5}$, that a standard should be set. I think there are 15,000 premature deaths annually as a consequence of occurrence of particulates and that was the reason that the CASAC Commission decided that a new $PM_{2.5}$ standard should be set.

It did not address the question of what the standard should be, but based upon that amount of premature deaths annually, it reached that conclusion. The vote was 19–2 as I recall.

Ms. Leyden, you've heard some complaints about this and yet you say you favor the proposed regulations.

Ms. LEYDEN. Yes.

Senator BAUCUS. What would you say in answer to some of the other witnesses that had some problems with these proposed regulations?

Ms. LEYDEN. Well, I guess from my vantage point, I've spent almost the last decade looking at how to reduce pollution and tailoring regulations to assess things like cost effectiveness, looking at what new technology can do. We've made phenomenal progress in the South Coast Air Basin and I see no reason at all not to first protect the public health and provide adequate time to get there.

I really believe for us, as I said in my comments, it will be additional NAAQS reductions, that will be needed to hit the 2.5 standard. It's the right thing to do and we can get those additional NAAQS reductions by focusing on sources that have yet to reduce their emissions to the same level as some of our largest industries have reduced them.

Senator BAUCUS. Mr. Chairman, if I might have one more question?

Senator INHOFE. Sure.

Senator BAUCUS. The vast amount of research on the question of whether the Clean Air Act benefits outweigh costs is overwhelmingly conclusive. That is in the affirmative by a factor of many times. All the studies on the Clean Air Act generally have reached the conclusion by a huge factor that the benefits of the Clean Air Act outweigh the cost of the Clean Air Act.

Yet, we also run into the problem of the tyranny of the majority, the tyranny of averages because some provisions of the Act may have disproportionate effects on some people or individuals compared to some others.

I think most of us are concerned about small business, that the cost on a particular small business person might be disproportionately greater than on a large enterprise.

Ms. Nichols, we heard Mr. Cooper say that perhaps the EPA could do a better job in implementing section 507 of the Clean Air Act, particularly with respect to small business. I think all of us in Congress are very sensitive to the unique characteristic of small business.

So on the aggregate, benefits vastly exceed the costs, we don't know if that is the case with respect to the new regulations, but we do know that is the case generally with the Act.

What are you doing at EPA to address the concerns of the small businessmen?

Ms. NICHOLS. Senator, we have a number of measures underway to do a better job of listening to and working with small business. I think in our programs implementing Title III of the Clean Air Act, the Toxics Program, we've had some of our best successes sitting down industry by industry as a group developing the data base jointly and coming up with regulations that can be met even when a particular sector is characterized by a great number of small businesses.

I would have to say as a resident of the South Coast Air Basin in my past and somebody who worked with Ms. Leyden and others on some of these programs, we have learned from the experience of the South Coast which has had to go further in terms of regulating small businesses because the problems were more severe and have found that in many situations, we were not doing as good a job as we should have of outreach.

Particularly on the enforcement side, some of the mechanisms that were being used to communicate and enforce against small businesses just weren't effective, that you needed to find ways to get the industry to help us to communicate what requirements were going to be.

One of my favorite examples is one where we worked with a particular industry to develop a standard and then helped them to develop a workbook that could be distributed to all of their individual members. It's kind of like a desk reference manual so that the person who is actually running one of these particular facilities can look up what the requirements are in plain English and not have to hire an engineer or a specific environmental person in order to help them run their business.

Those are the kind of practical realities that you have to deal with when you're actually working with small companies and try-

ing to get compliance and recognizing that they want to comply but oftentimes an assistance approach is what is needed.

EPA has funded the development of a number of small business compliance assistance centers for that reason. The Clean Air Act really led the way in that regard because of 507. We've worked with the State small business ombudspeople that were required to be created to help make them be more effective in carrying out these responsibilities.

There is no doubt we could do better at this and I think Mr. Cooper and others have given us some ideas as we move forward with this implementation committee as to how to bring in the small business community and really address their concerns earlier in the process.

Senator BAUCUS. Mr. Chairman, if you don't mind, if I might ask Mr. Cooper what more can be done to help address small business concerns?

Mr. COOPER. I can't tell you how happy I am you asked that question. Let me tell you the core of the problem and maybe some in the small business community would not appreciate my saying this but by and large, small business people are fairly limited in their options of what they can do. The thing I hear more than anything is just tell us what we have to do and we'll do it.

What that cries out for is very good guidance that isn't left subject to an engineer in Cleveland may be different engineer in Louisville, so you have guidance that is fairly clear-cut. Then you have to have the people available to answer the phone because there's a lot of fear out there. That's what the ombudsman program has provided.

The core of the problem with the ombudsman program is that it is funded out of permit fees and when you get down to the State level, Texas has one of the strongest ombudsman programs in the country and I think their funding is over $1 million for that program which is about 10 times what it is in most States.

If you're in a State and you're competing for dollars with the enforcement people and you're in technical assistance, you're going to lose. So what I would love to see is this committee to go over to the Appropriations Committee and set aside some funds to bolster the 507 Program. Without it, that program will die. There are a number of States that have cut back their programs already.

I am very concerned that when this new standard comes out, if these programs aren't in place, that's when the realities are going to hit and it is going to be a mess.

Senator BAUCUS. Thank you very much, Mr. Chairman, for your indulgence.

Senator INHOFE. Thank you, Senator Baucus.

Let me clarify one thing. You weren't here during the first panel and this whole idea on the 15,000 premature deaths is assuming causation. It's my understanding from the testimony of many of them that science has not been prepared to assume causation in that case in terms of the 15,000 premature deaths.

Senator BAUCUS. I don't know the number but I do know the overwhelming conclusion of CASAC is based upon the data and the number of deaths and they reached a conclusion 19–2 that a standard should be set.

Senator INHOFE. Then I have two more questions. I didn't quite use all my time and this is going to be very, very difficult for you, Ms. Nichols, because I'm going to ask you a question and I want one word for the answer and that answer would either be yes or no.

Senator Baucus talks about the fact that the benefits have outweighed the costs. I believe he was referring to the previous standards.

Under the proposed standards, I understand there is a regulatory impact analysis that came to the conclusion that the costs outweighed the benefits for ozone. Is that correct?

Ms. NICHOLS. No.

Senator INHOFE. OK. I will produce that report and we'll take that up at our next meeting.

One last question for Ms. Leyden. In your written testimony, although you didn't say it in your verbal testimony, you talked about additional reductions were needed to come from diesel sources such as planes, interstate trucks, agricultural equipment and so forth. For the purposes of classification, do you classify jet fuel as diesel?

Ms. LEYDEN. Yes, I would consider that a heavier fuel. It would be in that same category.

Senator INHOFE. That classification has been used by the EPA?

Ms. LEYDEN. My focus is on the heavier fuel type, sir.

Senator INHOFE. You had said you're getting cooperation from some of the large contributors and I'm glad to hear that. You said in addition, small internal combustion engines together emit more than the largest power plant in your area. Can you give me a couple of examples of small combustion engines?

Ms. LEYDEN. Small combustion engines would be anything less than 50 horsepower. They are protected under the Federal Clean Air Act and have an emissions standard that represents technology that today is 10 years old.

Senator INHOFE. Would that be either two cycle or four cycle?

Ms. LEYDEN. They'd be two cycle. We estimate, based on sales of equipment and fuel consumption, that emissions from that source category represents about 17 tons a day of nitric oxide emissions going into our air. That is almost four times greater than the emissions from the largest power plant in the basin.

Senator INHOFE. I'm going to end with a request, Ms. Nichols. On this issue of jet fuel being considered for your purposes the same as diesel, I spent 40 years in that field and I think I'd like to have you at least look and reevaluate that because I think you'll find it is a much cleaner burning fuel and I was not aware that you threw all those in together.

Maybe you don't, but if you could let me know on that, I'd appreciate it very much.

Ms. NICHOLS. I'll be happy to find out.

Senator INHOFE. Senator Baucus, do you have any last questions?

Senator BAUCUS. No.

Senator INHOFE. I appreciate the panel coming very much. We had said we were going to end right at 12 o'clock. We will have to do that because we're having an executive session over in the Capitol.

Thank you very much for coming and for the time you've taken to come here and testify.

[Whereupon, at 12:05 p.m., the subcommittee was adjourned, to reconvene at the call of the chair.]

PREPARED STATEMENT OF KENNETH W. CHILTON, DIRECTOR, CENTER FOR THE STUDY OF AMERICAN BUSINESS, WASHINGTON UNIVERSITY

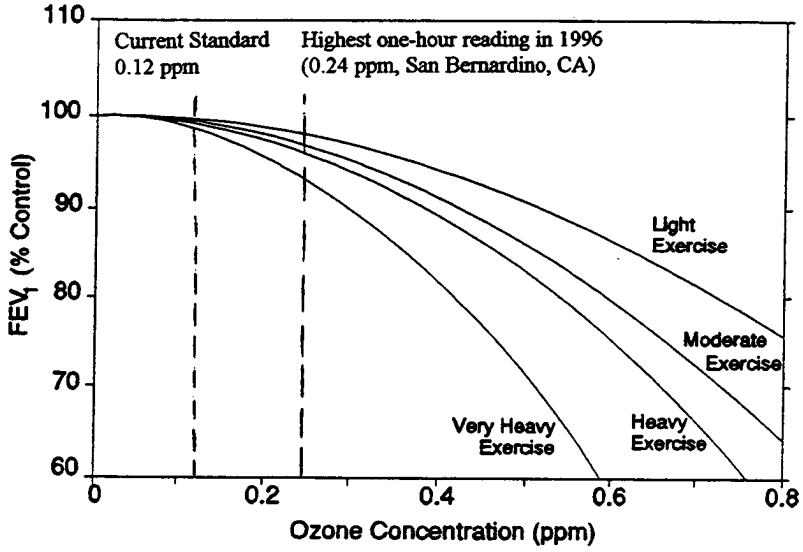
I wish to thank the Senate Subcommittee on Clean Air and Wetlands for the opportunity to testify on the proposed national ambient air quality standards for ozone and particulate matter.

I have researched clean air issues for over a decade and a half. I am the director of the Center for the Study of American Business, a 501(c)(3) non-partisan, not-for-profit public policy research organization at Washington University in St. Louis. These are my personal comments and do not necessarily reflect the views of the Center for the Study of American Business or Washington University.

I would like to address several of the most important public health questions in the NAAQS debate. I will also speak about some very basic issues regarding the primary objective of the Clean Air Act.

THE SCIENCE ON OZONE

The scientific evidence on the health effects of ozone is rather extensive. Ozone has been demonstrated to cause undesirable physical effects in some individuals. The effects include coughing, wheezing, tightness in the chest and reduced lung function—less volume of air exchanged with each breath. Based on EPA's estimate of the relationship between changes in forced expiratory volume (FEV) and various combinations of exercise levels and ozone concentrations, typical subjects experience less than a 5 percent loss in lung function even at the highest ozone levels recorded in the United States in 1996 (about twice the current standard).[1] (See Figure 1.) Medical experts do not consider lung function decrements of 10 percent, or less, an adverse health effect. The primary concern, however, is for ozone's effects on asthmatics or others especially sensitive to a combination of high ozone levels and moderate to heavy exercise.



[a] Lungfunction is measured as the volume of air a subject can force from his/her lungs in 1 second.
Source: *Review of the National Air Quality Standard for Ozone Assessment of Scientific and Technical Information* (Washington, DC.: U.S. EPA, Office of Air Quality Planning and Standards, June 1996), p. 31.

[a] Lung

No one should minimize the trauma that a severe attack of asthma causes the asthmatic or his or her loved ones. The EPA staff report, however, estimates that for each one million persons exposed, we can expect just one to three more summertime respiratory hospital admissions a day for each 100 parts per billion increase in ozone levels.[2] This is a very low incidence rate and a very high elevation in ozone levels. In a city of one million people, one to three added respiratory hospital admissions would be virtually undetectable. Such days would also be very rare even in cities with persistent ozone air quality problems.

EPA has recently modified its risk assessments for ozone, resulting in less public health benefits expected from the proposed NAAQS. For example, the new risk assessment projects that attainment of the proposed standard would lower New York City asthmatic hospital admissions caused by ozone to 109 per year, from 139 under the current standard.[3] That is a reduction of 30 hospital admissions, or one tenth of 1 percent of the 28,000 yearly asthmatic admissions. The previous estimate, contained in the Staff Paper, was that the standard would reduce yearly admissions by about 90.[4]

The revised risk assessments, which were conducted for nine urban areas, lower the expected benefit of the proposed standard in terms of other health effects, as well, especially for children playing out of doors. For example, EPA had previously expected 600,000 fewer occurrences of decreased lung function (instances where the amount of air that can be rapidly exhaled in 1 second decline by more than 15 percent) in children, but now projects just 282,000 such incidences. Anticipated improvements in episodes of moderate to severe chest pain in children were revised downward from 101,000 to 53,000, and the estimate for prevented cases of moderate to severe cough in children was lowered from 31,000 to 10,000.[5]

EPA's NAAQS proposal is based on the previous risk assessments. Because the revisions are large (reducing the expected benefit by half or more for several health effects), the wisdom of the proposed tighter standard is further called into question.

It is important to point out that, thus far, ozone has not been shown to cause premature mortality. The upper bound benefit estimate of $1.5 billion in EPA's Regulatory Impact Analysis of ozone, however, results almost entirely from the assumption that the proposed standard would save lives. This claim is unsubstantiated.

I also would like to note that a separate secondary standard to protect plants and buildings hardly seems justified. First, ozone concentration data for rural areas is very limited. Second, incremental cost and benefit estimates for meeting the proposed SUM06 secondary standard versus meeting the current 0.12 ppm goal have not been included in the agency's Regulatory Impact Analysis. Surely, we do not need to focus substantial financial and human resources preparing implementation plans to protect primarily commercial crops with no idea whether the hypothetical benefits outweigh the costs.

THE SCIENCE ON FINE PARTICULATES

Unlike the science on ozone's health effects, the science for fine particulates is not very developed and, thus, is plagued with uncertainties. EPA makes the claim that full attainment of the new fine particulate standard would result in between $69 billion and $144 billion worth of health benefits.[6] These predictions of extraordinary health benefits derive from estimates of reduced mortality from meeting a new fine particle standard. Whether the expected number of lives prolonged is 20,000, as stated by Administrator Browner when she testified before this subcommittee in February, or 15,000 as most recently predicted, or zero is hard to say given the paucity of scientific data supporting these projections.

The mortality improvements expected from reduced levels of fine particles are based not on thousands or even hundreds of studies, as the agency casually infers, but, in essence, from just two studies. These studies purport to show an association between $PM_{2.5}$ levels and death due to cardiovascular and pulmonary causes together and also a link between $PM_{2.5}$ and death.[7] It is curious, to say the least, that the statistical link that has been demonstrated is between fine particles and cardiopulmonary deaths, and not deaths due to respiratory disease or lung cancer alone.[8]

Perhaps it shouldn't be totally surprising that a fine particle-mortality link has not been demonstrated where one might expect, because medical science has not yet discovered a biologically plausible mechanism to explain how fine particulates cause any deaths. Without knowing more about the mechanism through which particulates might affect human health, the observed association between premature mortality and fine particles cannot be considered tantamount to a cause-and-effect relationship.

An additional scientific uncertainty with regard to these studies results from the problem of confounding. Confounding is a situation in which an observed association between an exposure and a health effect is influenced by other variables that also are associated with the exposure and affect the onset of the health effect. A variety of factors such as temperature, humidity, or the existence of other air pollutants may cause mortality rates to rise and fall with, and thus appear to be caused by, fine particulate concentrations.[9]

Also, before regulating air pollutants simply on a basis of size, more research is needed to try to identify which components, if any, of fine particulate matter are producing the observed association—ultrafine particles, nitrates, sulfates, metals, volatile (or "transient") particles, and so forth. We know very little about transient particles, which form and disappear quickly, and, therefore, go undetected by filter monitors.

Lack of air quality data for $PM_{2.5}$ is another serious problem. EPA Administrator Browner testified that there are 51 $PM_{2.5}$ monitors collecting air quality data at present.[10] The inference was that this is a large number; it is not. For example, in 1995 there were 972 monitors measuring ozone levels and 1,737 that collected data on PM_{10}.[11] For EPA to derive mortality estimates, $PM_{2.5}$ concentrations had to be projected for many cities where monitoring data do not exist.

Administrator Browner says the scientific evidence establishing the need for a fine-particle standard is "compelling." I respectfully disagree. A convincing case for a new fine-particle standard has not been made.

Epidemiological evidence is scant and indicates an association, not a cause-and-effect relationship. A toxicological explanation for the observed mortality and fine particle link has not been established. Exposure data are lacking due to the small number of monitors and this lack of data raises questions about the epidemiological studies. Setting a separate $PM_{2.5}$ standard at this time could be another case of "ready, fire, aim," as former EPA Administrator William Reilly once described past quick responses to perceived environmental problems.

Let me shift gears and raise a more fundamental issue that thus far has been missing in the debate over the proposed ozone and particulate air quality standards. The Clean Air Scientific Advisory Committee hinted at this problem but perhaps its language was a bit too obtuse.

THE CLEAN AIR ACT'S FLAWED GOAL

As the members of this subcommittee are well aware, the Clean Air Act calls on the Environmental Protection Agency to establish and enforce air quality standards that protect public health with an adequate margin of safety. It proscribes the consideration of economic factors in this process. Economics may come into play only at the implementation phase.

This is a very high-minded objective. Who but a Philistine could disagree with it?

Well, nearly any economist might. In a world of scarce resources (the real world), people have to be concerned about balancing incremental benefits with incremental costs. Spending more on one activity than it brings about in added benefits means that resources aren't available to spend on other desirable activities that could produce more benefits than their costs.

Theoretically, it might still be possible to protect public health with an adequate margin of safety and spend resources wisely, provided that the health-based standard can be set at a level where added health benefits equal or exceed added costs. Unfortunately, two factors are conspiring against this happy state.

First of all, all health effects from air pollution can't be eliminated, at least not for ozone. Physical responses to ozone can be demonstrated at background levels—levels produced by natural processes. This is what the Clean Air Scientific Advisory Committee (CASAC) was trying to get across in its closure letter to Administrator Browner when it wrote:

> The Panel felt that the weight of the health effects evidence indicates that there is no threshold concentration for the onset of biological responses due to exposure to ozone above background concentrations. Based on information now available, it appears that ozone may elicit a continuum of biological responses down to background concentrations. This means that the paradigm of selecting a standard at the lowest-observable-effects-level and then providing an "adequate margin of safety" is no longer possible.[12]

In plain English, the prime directive of the Clean Air Act is "mission impossible," at least for ozone. Taken literally, the standard would have to be set at a level produced by natural emissions of ozone precursors. The cost of such an effort is incalculable and the goal unattainable.

Second, the point where incremental costs equal benefits was crossed with respect to ozone with the passage of the 1990 Clean Air Act Amendments. The standard we are currently trying to meet is costing between $4 and $28 to produce $1 worth of benefits.[13] A more restrictive standard, such as the one proposed, has to be an even worse tradeoff. Cost estimates from private economists and at the Council of Economic Advisers confirm this expectation.

The Agency has presented some very modest figures for both benefits and costs in its Regulatory Impact Analysis (RIA). While the ozone standard being proposed was not specifically addressed in the RIA, its benefits should be bounded between $0 and $1.5 billion and its costs between $600 million and $2.5 billion, according to the impact analysis.[14] This figure most likely represents only a small fraction of the real cost of full attainment, for a variety of reasons. For example, full costs of attainment were calculated for only one to three cities.

Other estimates of costs and benefits are quite different, particularly on the cost side. Economist Susan Dudley predicts that full attainment of the current ozone standard will cost between $22 billion and $53 billion a year. The proposed standard would add an additional $54 billion to $328 billion to the price tag, according to Dr. Dudley.[15] Council of Economic Advisers member Alicia Munnell has projected added costs for meeting the new ozone standard of $60 billion a year.[16]

EPA's Regulatory Impact Analysis for the fine particulate standard estimates an annual cost of $6 billion for partial attainment. Like EPA's cost estimate for the ozone standard, this figure is most likely far too low.[17] EPA truncates costs at $1 billion per microgram (μg) of fine particle reduction, although most areas would incur costs to lower particulates that are much higher than this cutoff figure.

A sensitivity analysis performed for two cities, Denver and Philadelphia, demonstrates how quickly marginal cost rises above EPA's $1 billion/μg cutoff. In Philadelphia, the $1 billion/μg cutoff would result in a 20 percent reduction in $PM_{2.5}$ concentration from the 2007 baseline. An additional 1 percent reduction would result from a $2 billion/μg cutoff, but the cost would double. The RIA reports similar results for Denver.[18]

RECOMMENDATIONS

EPA is not required to tighten the ozone standard or to create a new $PM_{2.5}$ NAAQS. In the case of ozone, there is little evidence that a tighter standard will be more protective of those who are considered the sensitive population. For particulates, the science is not adequate to warrant a new $PM_{2.5}$ standard. Certainly, CASAC members were of quite divergent opinions on how to set a $PM_{2.5}$ standard. In her testimony, Administrator Browner made much ado about the fact that there was a consensus among CASAC members that a new $PM_{2.5}$ NAAQS be established. It is also true, however, that there was "no consensus on the level, averaging time, or form" of the standard.[19]

Indeed, on February 5, the chair of CASAC shared with this subcommittee just how tepid the support for the proposed fine particle standard was. Only two members of the 21-member CASAC endorsed a range for an annual $PM_{2.5}$ standard as strict as 15 $\mu g/m^3$ to 20 $\mu g/m^3$, yet EPA has proposed an annual limit of 15 $\mu g/m^3$. Eight of the members did not support any annual $PM_{2.5}$ standard.[20] (See Table 1.)

Given the rather poor state of atmospheric and medical scientific knowledge of fine particles, it is difficult to see how setting a standard at this time will produce meaningful health benefits. Rather than press forward with a tighter air quality standard for ozone and a new standard for fine particles, EPA should appeal to Congress and The White House to revisit the Clean Air Act.

Two basic reforms are required. First the fundamental objective of the Act needs to be changed from "protecting the public health with an adequate margin of safety" to "protecting the public against unreasonable risk of important adverse health effects." Second, benefit-cost analyses should be required, not proscribed, when setting air quality standards.

The American people expect their elected officials to protect them from air pollution that might significantly impair their health. They do not expect, however, that the costs of this protection will be so out of proportion to benefits that other desirable outcomes are forgone because economic resources have been applied too generously to this task.

Table 1.—Summary of CASAC Panel Members Recommendations for an Annual $PM_{2.5}$ Standard (all units $\mu g/m^3$)

Name	Discipline	$PM_{2.5}$ Annual
Ayres	M.D.	yes[2]
Hopke	Atmospheric Scientist	20–30
Jacobson	Plant Biologist	yes[2]
Koutrakis	Atmospheric Scientist	yes[2,3,4]
Larntz	Statistician	25–30[5]
Legge	Plant Biologist	no
Lippmann	Health Expert	15–20
Mauderly	Toxicologist	20
McClellan	Toxicologist	no[6]
Menzel	Toxicologist	no
Middleton	Atmostpheric Scientist	yes[2,3]
Pierson	Atmospheric Scientist	yes[2,7]
Price	Atmospheric Scientist/State Official	yes[8]
Shy	Epidemiologist	15–20
Samet[1]	Epidemiologist	no
Seigneur	Atmospheric Scientist	no
Speizer[1]	Epidemiologist	no
Stolwijk	Epidemiologist	25–30[5]
Utell	M.D.	no
White	Atmospheric Scientist	20
Wolff	Atmospheric Scientist	no
EPA Staff		12.5–20

NOTES:
[1] Not present at meeting; recommendations based on written comments
[2] Declined to select a value or range
[3] Concerned upper range is too low based on national $PM_{2.5}/PM_{10}$ ratio
[4] Leans toward high end of staff recommended range
[5] Desires equivalent stringency as present PM_{10} standards
[6] If EPA decides a $PM_{2.5}$ NAAQS is required, the 24-hour and annual standards should be 75 and 25 $\mu g/m^3$, respectively with a robust form
[7] Yes, but decision not based on epidemiological studies
[8] Low end of EPA's proposed range is inappropriate; desires levels selected to include areas for which there is broad public and technical agreement that they have $PM_{2.5}$ pollution problems

Source: CASAC Closure Letter on the Staff Paper for Particulate Matter, June 13, 1996, docketed as EPA–SAB–CASAC–LTR–96–008, Table 1.

NOTES

1. *Review of National Ambient Air Quality Standards for Ozone Assessment of Scientific and Technical Information OAQPS Staff Paper* (Research Triangle Park, N.C.: U.S. EPA Office of Air Quality Planning and Standards, June 1996), p. 31.
2. Ibid., p. 40.
3. R.G. Whitfield, *A Probabilistic Assessment of Health Risks Associated with Short-Term Exposure to Tropospheric Ozone: A Supplement* (Argonne, Illinois: Argonne National Laboratory, contracted for U.S. Environmental Protection Agency, January 1997), Table 6.
4. Ozone Staff Paper, p. 130.
5. Memorandum, "Supplemental Ozone Exposure and Health Risk Analyses," Harvey M. Richmond, EPA Risk and Exposure Assessment Group, to Karen Martin, EPA Health Effects and Standards Group, February 11, 1997.
6. *Draft Document Regulatory Impact Analysis for Proposed Particulate Matter National Ambient Air Quality Standard* (Research Triangle Park, N.C.: U.S. EPA Office of Air Quality Planning and Standards, December 1996), p. ES–20.
7. Douglas Dockery, C. Arden Pope III, Xiping Xu, John D. Spengler, James H. Ware, Martha E. Fay, Benjamin G. Ferris, Jr., Frank E. Speizer, "An Association Between Air Pollution and Mortality in Six U.S. Cities," *New England Journal of Medicine,* vol. 329, no. 24, December 9, 1993, pp. 1753–1759; C. Arden Pope III, Michael J. Thun, Mohan M. Namboodiri, Douglas W. Dockery, John S. Evans, Frank E. Speizer, Clark W. Heath, Jr., "Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults," *American Journal of Respiratory Critical Care Medicine,* vol. 151, 1995, pp. 669–674. Technically, while both Dockery et al. and Pope et al. show a link between increased mortality and fine particle concentrations, Pope et al. is the basis for EPA projections of lives prolonged by attaining the proposed $PM_{2.5}$ NAAQS.
8. William M. Landau, Gregory Evans, Raymond Slavin, letter to EPA Docket A–95–54, commenting on the proposed $PM_{2.5}$ NAAQS, March 7, 1997.

9. Suresh H. Moolgavkar and E. Georg Luebeck, "A Critical Review of the Evidence on Particulate Air Pollution and Mortality," *Epidemiology,* v. 7, n. 4, July 1996, pp. 420–428.
10. Testimony of EPA Administrator Carol Browner before U.S. Senate Committee on Environment and Public Works, February 12, 1997.
11. *National Air Quality and Emissions Trends Report, 1995* (Research Triangle Park, N.C.: U.S. EPA Office of Air Quality Planning and Standards, October 1996), p. 163.
12. Clean Air Scientific Advisory Committee closure letter to EPA Administrator Carol Browner on the primary standard portion of the OAQPS Staff Paper for ozone (November 31, 1995), p. 2.
13. Kenneth Chilton and Stephen Huebner, *Has the Battle Against Urban Smog Become "Mission Impossible?"* (St. Louis: Center for the Study of American Business, Policy Study 136, November 1996), p. 14.
14. *Regulatory Impact Analysis for Proposed Ozone National Ambient Air Quality Standard* (Research Triangle Park, N.C.: U.S. EPA Office of Air Quality Planning and Standards Innovative Strategies and Economics Group, December 1996), p. ES–22.
15. Susan E. Dudley, *Comments on the U.S. Environmental Protection Agency's Proposed National Ambient Air Quality Standard for Ozone* (prepared for the Regulatory Analysis Program, Center for the Study of Public Choice, George Mason University, March 12, 1997), p. ES–3.
16. Memorandum from Alicia Munnell, Council of Economic Advisers, to Art Fraas, Office of Management and Budget, December 13, 1996.
17. Thomas Hopkins, *Can New Air Standards for Fine Particles Live Up to EPA Hopes?* (St. Louis: Center for the Study of American Business, Policy Brief 180, April 1997), pp. 10–17.
18. *Regulatory Impact Analysis,* p. 7.6.
19. Clean Air Scientific Advisory Committee closure letter to EPA Administrator Carol Browner on the Staff Paper for Particulate Matter (June 13, 1996), p. 2.
20. Ibid., Table 1.

TESTIMONY OF THOMAS B. STARR, PH.D. AND PRINCIPAL, ENVIRON INTERNATIONAL CORPORATION

Good morning. I very much appreciate the opportunity to testify before this Senate Subcommittee regarding the U.S. Environmental Protection Agency's (EPA) proposed new standards for particulate matter.

My name is Thomas B. Starr. I am a Principal with ENVIRON International Corporation, a consulting firm headquartered in Arlington, Virginia, that specializes in health and environmental science issues related to chemical exposures, pharmaceuticals, medical devices, and food products, pesticides, and contaminants. My own consulting activities focus on the development and use of effective methods for incorporating scientific knowledge of toxic mechanisms into the quantitative risk assessment process. A brief biographical sketch is attached (Appendix A).

The comments I offer today are drawn principally from two separate consulting projects in which we have performed a critical examination of the scientific evidence for potentially causal associations between particulate matter (PM) exposure and adverse human health effects. In the first project, undertaken on behalf of the American Petroleum Institute, three world-renowned epidemiologists, Drs. Raymond Greenberg, Provost and Vice-President for Academic Affairs, Medical University of South Carolina, Jack Mandel, Chairman, Department of Environmental and Occupational Health, School of Public Health, University of Minnesota, and Harris Pastides, Chairman, Department of Epidemiology and Biostatistics, from the School of Public Health at the University of Massachusetts, were brought together as an Expert Panel to independently and objectively assess the quality of the epidemiologic evidence for associations between PM exposure and increased human morbidity and mortality.

In the second project, undertaken on behalf of Kennecott Corporation, an ENVIRON colleague, Dr. Larisa Rudenko, and I also evaluated the case for such causal associations, and, in addition, assessed the credibility of health benefits that EPA has projected would accrue from implementation of the proposed new PM standards.

The final reports from these projects were submitted to EPA and are included along with my oral testimony for your information. My remarks today briefly summarize their findings; I refer you to the full reports for additional details.

First, the issue of causality, or whether the effects observed are truly caused by the exposure to PM, specifically $PM_{2.5}$, or some other component of air pollution or

lifestyle. In assessing whether the results from epidemiologic studies support the existence of a causal relationship between exposure and disease, criteria developed initially by Bradford Hill (1965) are often applied. These include the strength, consistency, coherence, specificity, and temporality of the reported association. Although not explicitly stated, a presumption exists that the validity of the association has been established prior to consideration of these criteria. What this means is that the estimates of the association's strength have been shown to be free of significant biases and not significantly confounded. The Expert Panel of epidemiologists and our independent review both concluded that the studies of PM and disease do not satisfy these conditions; they have inadequately addressed potential biases and they have failed to resolve satisfactorily the issue of confounding.

Even if the issue of validity were to be set aside, the Hill criteria would not be met. The reported associations are extremely weak and vacillate between positive and negative based on the specific regression model that has been used to characterize the dose-response relationship; as copollutants are introduced into the analyses, apparently positive associations attenuate in strength, often to non-significance. Indeed, based on the criterion of strength of association, it is difficult to imagine a weaker case for causality than that posed by the data on PM and mortality or morbidity.

Furthermore, the results of the studies are not actually as consistent as they might at first appear. For example, different exposure measures (e.g., mean daily level, maximum daily level, or some lagged estimate) have been associated with different endpoints (e.g., respiratory diseases, cardiovascular diseases, or total deaths). Also, temporal relationships between exposure variables and disease occurrence are not the same across studies, with lag times varying from concurrent day to several days earlier.

In addition, a critically important component of coherence, namely, dose-response, is, at best, weakly established in only a few studies. In virtually all of the epidemiologic studies of PM, exposure levels have not been not based on personal dosimetry, but rather on stationary samplers located in specific geographic areas. Individual subjects were thus assigned "community-wide" measures of exposure, rather than individual measures. The lack of personal exposure measures limits the ability to conclude that any individual death is linked to air pollution *per se*. In fact, there is a large body of data indicating that community sampler measurements rarely provide good estimates of individual exposures.

Even if a causal association were in fact to exist between PM exposure and disease occurrence at the individual level, such "ecological" exposure estimates would likely misrepresent the association's true strength. Equally important, the shape of the underlying dose-response relationship would also likely be significantly distorted by ecologic analyses, with sharp threshold-like curves being smoothed into more nearly linear curves by exposure misclassification.

Another major challenge to the case for causality relates to the nature of PM exposure, which invariably occurs in combination with exposure to other air pollutants such as ozone, carbon monoxide, SO_2, H_2SO_4, metals, and volatile organics. Because this mixture's composition varies according to source, season, time of day, weather conditions, and geographic region, and because PM is itself a complex and highly variable mixture, it has been virtually impossible to disentangle the potential adverse health effects of PM, or a specific PM fraction, such as $PM_{2.5}$, from those potentially attributable to other confounding copollutants.

The question of whether the coarse and/or fine particulate components of air pollution are causally related to adverse human health effects is one of great importance. If there is a causal relationship, identification and establishment of a safe and acceptable level of ambient particulate matter will be a decision with enormous consequences. However, the severe methodological limitations of existing studies prevent a conclusive judgment about the causality of associations between PM exposure and adverse health effects at the present time. EPA's proposal for new PM standards is premature.

There is an obvious need for new epidemiologic studies that collect data at the individual subject level. Carefully designed case-control studies can also be effective. It is especially important that future study designs be related to clearly articulated theories about the specific mechanistic pathways through which particulate air pollution may affect human health. To serve as a basis for regulatory decisionmaking, future epidemiologic studies will be most useful if they inform us about the specific manner in which individual air pollution constituents might affect human health. The current epidemiologic literature falls well short of this goal.

The stated purpose for USEPA's proposed new PM standards is to:

> ". . . provide increased protection against a wide range of PM-related health effects, including premature mortality and increased hospital admissions and emergency room visits (primarily in the elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (in children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms." (*Fed Reg* 61:65638)

How confident can we be that the proposed new PM standards will in fact lead to increased human health protection? The quantitative risk assessment conducted for EPA by Abt Associates, Inc. attempts to quantify the uncertainty inherent in the estimated health benefits from the new standards. This assessment is very thorough in its identification of many weaknesses in the underlying PM and health effects data, remarkably frank about its necessary reliance on numerous unproven assumptions, and surprisingly even-handed in its demonstrations, via multiple sensitivity and uncertainty analyses, that the health benefits projected from the proposed standards might well be greatly exaggerated.

Significant limitations of EPA's benefit projections either noted in the Abt Associates, Inc. risk assessment are in our critique of it and include the following:

> Because correlation is not causation, the projections have had to assume causation; thus, future reductions in specific PM levels need not necessarily result in any material health benefits. This has not been acknowledged explicitly.
>
> EPA's failure to account for the potential health effects due to simultaneous exposure to PM, other pollutants, and related weather variables almost certainly leads to substantial overstatements of both the strength and statistical significance of the apparent associations specifically with PM exposure. This issue of confounding has been explored only to a very limited extent, yet EPA has concluded that its benefit estimates are robust to the inclusion or exclusion of individual co-pollutants. This conclusion is at variance with the findings of several reanalyses that considered multiple confounding variables simultaneously. The discrepancy is almost certainly due to the fact that EPA's sensitivity analyses considered only "one-at-a-time" additions of individual co-pollutants instead of real-world multiple exposures. Thus, the true benefits that result from compliance with the proposed new PM standards may well be completely negligible.
>
> The benefit projections assume log-linear relationships between PM exposure above natural background levels and various adverse health outcomes. Because most days of the year have low to mid-range levels of PM, the estimated health benefit over an entire calendar year of daily PM exposures is dominated by the contribution from the many days with low to moderate levels of PM. This is precisely the exposure range for which the empirically determined log-linear dose-response relationships are most uncertain. The assumption of a log-linear no-threshold dose-response relationship is not presently scientifically justified; threshold-like alternatives cannot be ruled out.
>
> EPA's sensitivity analysis using different cut points (i.e., thresholds) demonstrates the enormous impact that thresholds can have on the projected benefits from proposed new standards. High thresholds imply negligible health benefits. Nevertheless, health benefits estimated with threshold-like dose-response relationships play only a secondary role in EPA's benefits assessment. They should instead be considered at least on an equal footing with the benefits estimated with log-linear models.
>
> EPA's regression models presume implicitly that the independent variables are known without error. Yet actual PM exposure levels are very poorly characterized and highly uncertain. EPA has acknowledged that little regional monitoring data, and virtually no personal exposure data, are available for $PM_{2.5}$ at the present time. Furthermore, recent studies have shown that only weak correlations exist between individual personal exposures and PM measures recorded by regional monitoring stations. Uncertainty about the true values of these variables, or errors in their measurement, leads to a serious "errors in variables" problem that can only be resolved with further prospective study involving adequate simultaneous measurements of both individual PM exposures and region-wide measures of air quality.

Faced with such great uncertainty in the estimated magnitude of potential health impacts of the proposed new standards, it seems far more reasonable for EPA to initiate additional data collection and analysis activities on the health effects poten-

tially associated with various PM fractions rather than rush to promulgate and implement new standards that could well make things worse rather than better.

That completes my oral testimony. Thank you for your attention. I would be happy to answer any questions.

APPENDIX A

THOMAS B. STARR trained in theoretical physics at Hamilton College and the University of Wisconsin-Madison, receiving his Ph.D. in 1971. Following National Science Foundation postdoctoral and faculty appointments in the Institute for Environmental Studies at Wisconsin, he joined the staff of the Chemical Industry Institute of Toxicology in 1981, first as a senior scientist in the Department of Epidemiology, and then in 1987 as Director of CIIT's Program on Risk Assessment. In 1989, he joined ENVIRON International Corporation as a principal in the Health Sciences Division. His research interests have focused on means for explicitly incorporating knowledge of toxic mechanisms into the quantitative risk assessment process, and improving epidemiologic methods for assessing effects of chemical exposure on worker health. He has published over 80 scientific papers and abstracts, and given hundreds of scientific presentations.

Dr. Starr holds an adjunct faculty appointment in the Department of Environmental Sciences and Engineering in the School of Public Health at the University of North Carolina-Chapel Hill. He has been appointed to numerous advisory posts, including the Halogenated Organics Subcommittee of the U.S. Environmental Protection Agency's Science Advisory Board, the North Carolina Academy of Sciences Air Toxics Panel, and the North Carolina Environmental Management Commission Ad Hoc Committee for Air Toxics. Currently, he serves on the Methylene Chloride Risk Characterization Science Committee, and the Secretary's Scientific Advisory Board on Toxic Air Pollutants for the North Carolina Department of Environmental Health and Natural Resources. He has testified before OSHA, EPA, and other regulatory agencies regarding human health risks posed by various chemical exposures, including those to 1,3-butadiene, cadmium, dioxin-like compounds, formaldehyde, lead, methylene chloride, and environmental tobacco smoke. He is also active in professional societies, including the American Statistical Association, the Society for Epidemiological Research, the Society for Risk Analysis, and the Society of Toxicology. In 1988–89 he served as the first President of the newly formed SOT Specialty Section on Risk Assessment, and in 1989–90 as President of the Research Triangle Chapter of the Society for Risk Analysis.

COMMENTS TO USEPA ON THE PROPOSED NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER: The Quantitative Risk Assessment

on behalf of
Kennecott Corporation
Salt Lake City, Utah

Submitted by
ENVIRON International Corporation
Arlington, Virginia
Raleigh, North Carolina

March 7, 1997

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I. EXECUTIVE SUMMARY

On 13 December 1996, the United States Environmental Protection Agency proposed new National Ambient Air Quality Standards for particulate matter (USEPA 1996, Federal Register 61:65638-65713). The USEPA proposal would retain the current primary standards for PM_{10} with minor changes, and add new annual and 24-hour standards for $PM_{2.5}$, specifically, a primary annual standard of 15 $\mu g/m^3$, and a 24-hour standard of 50 $\mu g/m^3$, based upon a 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations at each monitor within an area.

The stated purpose for USEPA's proposal of new PM standards is to:

> "...provide increased protection against a wide range of PM-related health effects, including premature mortality and increased hospital admissions and emergency room visits (primarily in the elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (in children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms." (*Fed Reg* 61:65638)

ENVIRON International Corporation, on behalf of Kennecott Corporation, has undertaken a critical review and analysis of USEPA's quantitative risk assessment for PM to determine the extent to which the proposed new PM standards would lead to increased protection in the form of decreased frequencies of occurrence of the above-noted health effects. This risk assessment, conducted by Abt Associates, Inc. for USEPA, is very thorough in its identification of many weaknesses in the underlying PM and health effects data, its reliance on numerous critical but unproven assumptions, and its demonstrations, via multiple sensitivity and uncertainty analyses, that the health benefits projected from implementation of the proposed standards may well be greatly exaggerated. The Abt risk assessment also acknowledges that there are other critical factors that could not be systematically explored because the data required for such analyses were not available. These factors include exposure measurement error, the important distinction between average ambient PM concentrations and individual personal exposures, and inadequate control for weather variables and multiple co-pollutants during the estimation of health effects attributable to specific PM fractions,.

Had these additional factors been appropriately considered, they would serve only to further increase the already great uncertainty, acknowledged explicitly and often in the Abt Associates, Inc. quantitative risk assessment, regarding the magnitude of potential health benefits that might accrue from implementation of more stringent PM standards. Because a causal

association between adverse health effects and specific PM fractions has not yet been established, because other uncontrolled factors may actually be responsible for the apparent effects of PM, the benefits from further PM reductions are likely to be nonexistent or undetectable. The numerous limitations and weaknesses of USEPA's risk assessment argue strongly and convincingly against the implementation of new PM standards at the present time. The currently available scientific data are simply inadequate to justify new PM standards.

Specific conclusions and recommendations issuing from ENVIRON's critical analysis of the Abt Associates, Inc. risk assessment include the following:

(1) The absence of personal exposure data has forced the Agency to rely on correlative "ecologic" studies relating city-wide indices of PM exposure to population indices of morbidity and mortality.

(2) Because correlation is not causation, the risk assessment has had to *assume* causation; thus, future reductions in specific PM levels need not necessarily result in *any* material health benefits. USEPA needs to acknowledge this fundamental and critical limitation of its risk assessment.

(3) Actual PM exposure levels are very poorly characterized and highly uncertain. USEPA has explicitly acknowledged that little regional monitoring data, and virtually no personal exposure data, are available for $PM_{2.5}$ at the present time. Furthermore, recent studies have shown that only weak correlations exist between individual personal exposures and PM measures recorded by regional monitoring stations.

(4) At present, there is no clear understanding of the physiological mechanisms, if any, that may be responsible for the statistical associations that have been observed between fluctuations in ambient PM levels and the frequency of adverse health outcomes. Additional careful study is required to clarify the causation issue, to identify specific constituents of air pollution that may be responsible for adverse health effects, and to identify specific physiologic mechanisms by which such effects might arise. Only when such studies are completed will it be possible to scientifically justify stricter regulation of specific air pollution constituents.

(5) USEPA's failure to account explicitly for the potential health effects due to simultaneous exposure to PM, other pollutants, and related weather variables almost certainly leads to substantial overstatements of both the strength and statistical significance of the apparent

associations of adverse health outcomes specifically with PM exposure. The USEPA quantitative risk assessment explores the issue of confounding variables only to a very limited extent in some of its sensitivity analyses, and it has concluded that effect estimates are robust to the inclusion or exclusion of individual co-pollutants. This conclusion is at variance with the findings of several reanalyses which considered multiple confounding variables simultaneously. The discrepancy is almost certainly due to the fact that USEPA's sensitivity analyses considered only "one-at-a-time" additions of individual co-pollutants. The true benefits that result from compliance with the proposed new PM standards may be completely negligible if co-pollutants or inadequately addressed weather variables are indeed responsible for the adverse health effects of air pollution.

(6) USEPA has *assumed* log-linear relationships between PM exposure above natural background levels and various adverse health outcomes. Furthermore, most days of the year have low to mid-range levels of PM, while days with high PM values, such as those associated with the 98th percentile, by definition, occur only infrequently. Thus, the estimated aggregate risk accumulated over an entire calendar year of daily PM exposures is dominated by the contribution from the many days with low to moderate levels of PM. This is precisely the exposure range for which the empirically determined log-linear concentration-response relationships used by USEPA are most uncertain. The assumption of a log-linear no-threshold concentration-response relationship is not presently scientifically justified. Careful prospective studies of personal PM exposures in relation to adverse health outcomes will be necessary to shed additional light on this issue.

(7) The sensitivity analysis conducted in USEPA's quantitative risk assessment using different cut points (i.e, thresholds) demonstrates the enormous impact that thresholds can have on the projected benefits from proposed new standards. High thresholds imply negligible health benefits. Although health benefits estimated with threshold-like concentration-response relationships play only a secondary role in certain sensitivity analyses included in USEPA's risk assessment, they deserve a prominent role in the risk assessment, and should be considered at least on an equal footing with the benefits estimated with log-linear models.

(8) USEPA's regression models for concentration-response relationships presume implicitly that the independent variables are known without error. Uncertainty about the true values of these variables, or errors in their measurement, leads to an "errors in variables" problem that USEPA's risk assessment has failed to deal with effectively; it has merely

acknowledged this issue as an important source of uncertainty, without quantifying the extent of that uncertainty. Furthermore, none of the "ecologic" epidemiologic studies upon which USEPA has relied have dealt effectively with this "errors in variables" problem. This difficulty can only be resolved with further prospective study involving adequate simultaneous measurements of both individual PM exposures and region-wide measures of air quality.

Faced with such great uncertainty in the estimated magnitude of potential health impacts of the proposed new standards, it seems far more reasonable for USEPA to initiate additional data collection and analysis activities on the health effects potentially associated with various PM fractions rather than rush to promulgate and implement new standards that could well make things worse rather than better.

II. INTRODUCTION

On 13 December 1996, the United States Environmental Protection Agency formally announced its proposal for new National Ambient Air Quality Standards for particulate matter (USEPA 1996 Federal Register 61:65638-65713). Current primary particulate matter (PM) standards are based upon that fraction of total suspended particulate matter designated as PM_{10}, indicating those particles with a mean aerodynamic diameter of 10 microns or less. The current *annual* standard prohibits airborne PM_{10} concentrations from exceeding 50 $\mu g/m^3$ on an annually averaged basis. The current *24-hour* PM_{10} standard allows no more than one exceedance of 150 $\mu g/m^3$ at each monitor in a location per year. The USEPA has proposed to retain the current primary *annual* standard for PM_{10} of 50 $\mu g/m^3$, and the current primary *24-hour* standard of 150 $\mu g/m^3$ as well, although the latter would be converted in the new proposal to a 98th percentile form, averaged over three years.

In addition, USEPA has proposed new annual and 24-hour standards for particulate matter designated as $PM_{2.5}$, indicating particles with a mean aerodynamic diameter of 2.5 microns or less. Particulate matter in this class comprises a variable subset of PM_{10} with the ratio of the $PM_{2.5}$ fraction to the PM_{10} fraction varying widely in magnitude, depending on the source category of origin of the particulate matter, as well as time of day, weather conditions, and geographic region. The $PM_{2.5}$ fraction has previously been regulated only through the existing PM_{10} standard. The proposed new primary *annual* standard for $PM_{2.5}$ is 15 $\mu g/m^3$, based upon a 3-year average of the annual arithmetic mean, spatially averaged across an area. The corresponding new *24-hour* standard is 50 $\mu g/m^3$, based upon a 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations at *each* monitor within an area.

In announcing its decision to move forward with these new standards, USEPA identified two alternative sets of new $PM_{2.5}$ standards it is also considering, one more stringent, the other more relaxed, than its primary proposal. The less stringent set, comprised of a 20 $\mu g/m^3$ *annual* standard with a *24-hour* standard as high as 65 $\mu g/m^3$, was put forward in recognition of the very large degree of uncertainty which currently exists regarding actual $PM_{2.5}$ levels (little actual monitoring data are available at the present time), and the absence of any clear understanding of the physiological mechanisms, if any, that may be responsible for the statistical associations that have been observed between various measures of PM exposure and adverse health outcomes. Additional uncertainties with regard to (1) the identity of the true causal agent(s) in the complex mixture of air pollutants of which $PM_{2.5}$ is but one constituent, and (2) the possible existence of threshold-like dose-response relationships also serve to intensify concern that costly regulatory initiatives aimed at restricting the $PM_{2.5}$ fraction are premature and, at best, very inefficient.

The more stringent alternative set of standards, characterized by USEPA as a "maximally precautionary response," is comprised of an *annual* $PM_{2.5}$ standard as low as 12 $\mu g/m^3$ in combination with a *24-hour* standard in the range of 20 to 50 $\mu g/m^3$. It appears to have arisen in response to the view of some public health advocates that the existing epidemiological data are already sufficient to demonstrate a causal relationship between $PM_{2.5}$ and adverse health outcomes, even at remarkably low exposure levels.

The stated purpose for USEPA's proposal of new PM standards is to:

> "...provide increased protection against a wide range of PM-related health effects, including premature mortality and increased hospital admissions and emergency room visits (primarily in the elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (in children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms." (*Fed Reg* 61:65638)

Will the proposed standards provide such protection? This is a straight-forward question with no simple answer. USEPA has undertaken an elaborate quantitative risk assessment to determine the extent to which the new PM standards would lead to increased protection in the form of decreased frequencies of occurrence of the above-noted health effects. Quantitative risk assessment is a challenging, technically complex activity involving the analysis of large amounts of data of varying types and quality, the development of scientific inferences with regard to various quantitative functional relationships among these data, and the formulation of numerous simplifying and/or data gap-filling assumptions, both explicit and implicit, that have not been and, perhaps, cannot ever be validated empirically.

USEPA's quantitative health effects assessment for PM is quite complex and, in many respects, very thoughtful, but it does not provide substantial support for the Agency's assertion that the proposed standards will indeed provide increased protection of the public health. Far too many critical issues currently remain unresolved to have confidence that new $PM_{2.5}$ standards will provide any real public health benefits.

Indeed, USEPA's quantitative risk assessment of PM is very thorough in its identification of many weaknesses in the underlying data, its reliance on numerous critical but unproven assumptions, and its demonstrations, via multiple sensitivity analyses, that the health benefits projected from implementation of the proposed standards may well be greatly exaggerated. There are, in addition, other critical factors that could not be systematically explored in the risk

assessment because the data required for such analyses were not available. These factors include exposure measurement error, the important distinction between average ambient PM concentrations and individual personal exposures, and inadequate control for multiple co-pollutants, as well as related weather variables, during the estimation of health effects due to specific PM fractions.

Had these additional factors been appropriately considered, they would serve only to further increase the already great uncertainty, acknowledged explicitly and often in USEPA's quantitative risk assessment, regarding the magnitude of potential health benefits that might accrue from implementation of more stringent PM standards. Because a causal association between adverse health effects and specific PM fractions has not yet been established, because other uncontrolled factors may actually be responsible for the apparent effects of PM, the benefits from further PM reductions may well be nonexistent. The numerous limitations and weaknesses of USEPA's risk assessment argue strongly and convincingly against the implementation of new PM standards at the present time.

After briefly describing the approach USEPA has taken in estimating the health benefits that might ensue from new PM standards in the next section, we return to discuss in further detail the serious limitations in the current state-of-the-science for quantitative risk assessment of PM.

III. USEPA'S QUANTITATION OF POTENTIAL HEALTH EFFECTS FROM EXPOSURE

USEPA contracted with Abt Associates Inc., Cambridge MA, to complete a quantitative risk assessment of the human health risks associated with PM exposure for two example cities, Philadelphia and Los Angeles. Their charge was to develop numerical estimates of the extent to which the proposed new standards would afford increased public health protection. Using daily monitoring data for PM_{10} and $PM_{2.5}$ recorded in Philadelphia during the period September 1992 through August 1993, similar data for Los Angeles during the 1995 calendar year, estimates of the "natural background" PM levels thought to be appropriate for these cities, as well as city-specific baseline incidence rates for the health effects of interest and estimated log-linear concentration-response functions drawn from several different literature sources, Abt Associates developed estimates of the increased annual incidence of various health endpoints associated with:

1) "as is" PM conditions;

2) PM conditions that were (at worst) in compliance with the existing PM_{10} standards (compliance was simulated via a proportional rollback of all PM_{10} and $PM_{2.5}$ values by whatever percentage was required to bring the most out-of-compliance PM_{10} observation into compliance);

3) PM conditions in compliance with the new proposed standards (simulated with a similar proportional rollback scheme).

As was noted above, the concentration-response functions employed by Abt Associates in the quantitative risk assessment were extracted from the extant epidemiologic literature on health effects associated with PM exposure in numerous locations, including the well-known "Six Cities," namely, Watertown MA, Kingston/Harriman TN, Saint Louis MO, Steubenville OH, Portage WI, and Topeka KA. For each study, Abt Associates determined the increased relative risk for a given health effect that would be expected, based on that study's findings, to result from an increase of either 50 $\mu g/m^3$ in PM_{10} or 25 $\mu g/m^3$ in $PM_{2.5}$. Corresponding standard errors for these "standardized" relative risk estimates were also determined. It is important to note that the log-linear form of the assumed concentration-response functions employed by USEPA in their main analyses guarantees that all PM increments above "natural background" levels, no matter how small, will yield proportionate nonzero increases in calculated relative risks. (For relative

risks reasonably close to unity, there is little, if any, practical difference between log-linear and purely linear concentration-response relationships.)

Pooled estimates of effect, derived by combining the results across multiple studies and locations with either fixed or random effects models of inter-location variability, were also constructed and employed as appropriate. When a random effects model was utilized in the calculation of benefits from PM reductions, 90% *credible* intervals were substituted for corresponding 90% *confidence* intervals arising from analyses based on a fixed effect model. Such intervals allow for the fact that the actual distribution of random effects across locations is unknown, and hence must be estimated, thereby introducing additional variability into the estimates of effect beyond that attributable to sampling. *Credible* intervals are always at least as wide as the confidence intervals that would follow from perfect knowledge of the distribution of random effects across locations.

The differentials in health effects incidence between simulated compliance with the current PM_{10} standards and simulated compliance with the proposed new standards were then taken to be the net health benefit that resulted from implementation of a given proposed standard. For example, in the proposed rule, USEPA reports that:

> "The incidence of mortality associated with short-term $PM_{2.5}$ exposures upon attainment of the current PM_{10} standards was estimated to range from approximately 400 to 1,000 deaths per year in Los Angeles County (with a population of 3.6 million) under base case assumptions ..." (*Fed Reg* 61:65650)

This estimated range of mortality incidence for Los Angeles county (rounded to one significant figure from the range of 430 to 970 deaths) was reported in Exhibit 7.3 of the 3 July 1996 Abt Associates risk assessment report. In the December 1996 supplement to that report as revised in November 1996, the reduction in this range was projected to be approximately 210 to 480 deaths (with a central reduction estimate of 350 deaths) for $PM_{2.5}$ levels in compliance with the new proposed 15 $\mu g/m^3$ annual spatially averaged standard in combination with a 98th percentile 24-hour standard of 50 $\mu g/m^3$ (see Exhibit 8 in the December 1996 supplement).

For comparison, in Philadelphia, under "as is" PM conditions, which were already in compliance with the current PM_{10} standards during the period September 1992 through August 1993, short term $PM_{2.5}$ exposures were estimated to have caused 200 to 500 deaths (rounded to one significant figure from 220 to 510 deaths as reported in Exhibit 7.1, 3 July 1996 Abt report). Moving into compliance with the above-noted new standards for $PM_{2.5}$ was estimated to reduce this range by from 30 to 60 deaths (as reported in Exhibit 7 of the December 1996 supplement).

Estimated reductions in adverse health effects resulting from compliance with the proposed new standards were similarly developed for mortality arising from long-term PM exposure, hospital admissions for respiratory and cardiac conditions, the latter for individuals at least 65 years of age and split into admissions specific for ischemic heart disease and congestive heart failure, and finally, the incidence of lower respiratory tract symptoms among 8-12 year old children.

For example, from 23,000 to 58,000 8-12 year old children were estimated to exhibit lower respiratory tract symptoms associated with $PM_{2.5}$ exposure in Southeast Los Angeles County during 1995, with PM levels adjusted to attain compliance with current PM_{10} standards (Exhibit 7.3 of the November 1996 revision to the 3 July 1996 Abt Associates risk assessment report). In the December 1996 supplement to that report, the reduction in this range was estimated to be from 12,000 to 34,000 cases, (with a central reduction estimate of 24,000 cases) for $PM_{2.5}$ levels in compliance with the new proposed 15 $\mu g/m^3$ annual spatially averaged standard in combination with a 98th percentile 24-hour standard of 50 $\mu g/m^3$ (see Exhibit 8 in the December 1996 supplement).

For comparison, in Philadelphia, under "as is" PM conditions, which were already in compliance with the current PM_{10} standards during the period September 1992 through August 1993, short term $PM_{2.5}$ exposures were estimated to have been responsible for 6,000 to 15,000 cases of lower respiratory tract symptoms among 8-12 year old children (Exhibit 7.1, 3 July 1996 Abt report). Moving into compliance with the above-noted new standards for $PM_{2.5}$ was estimated to reduce this range by as many as 1,000 to 2,000 cases (as reported in Exhibit 7 of the December 1996 supplement).

It is noteworthy that USEPA's estimates of adverse health effects associated specifically with the $PM_{2.5}$ fraction were developed from very limited data bases compared to those for PM_{10}. For short-term mortality, estimates were derived solely from the expanded Six Cities study of Schwartz et al. (1996); estimates of chronic mortality were developed solely from the study of 51 U.S. cities by Pope et al. (1995); finally, respiratory disease estimates were extracted from the single Thurston et al. (1994) study of Ontario, Canada. All other estimated reductions in adverse health effects were of necessity related to measurements of PM_{10}.

IV. SUMMARY OF SIGNIFICANT LIMITATIONS AND WEAKNESSES OF THE PM RISK ASSESSMENT

A. Reliance on Empirically Estimated "Ecologic" Concentration-Response Relationships

The epidemiologic studies upon which USEPA has relied in developing its estimates of concentration-response functions have a number of serious methodologic limitations. Many of these limitations are discussed in considerable detail in the companion ENVIRON report which is focussed on the critical issue of causality (ENVIRON 1997). Both individually and collectively, these studies have yet to clearly demonstrate that the observed associations between PM exposure and adverse health effects are causal in nature. Here we discuss three specific issues related to the absence of demonstrated causality with significant implications for the benefits USEPA has estimated to arise from compliance with the proposed new standards: (1) the lack of predictive power of correlative, as opposed to causal, associations; (2) the important distinction between monitoring measurements of ambient PM levels and individual personal exposure measures, and (3) inadequate control for various potentially confounding variables including co-pollutants.

1. Correlative associations lack predictive power

Correlation is indeed not causation. If the association between PM exposure and adverse health consequences is solely, or even partly, due to factors other than PM_{10} or $PM_{2.5}$ that happen to have co-varied historically with both the PM levels and the incidence of adverse health effects in the past, then future reductions in specific PM levels need not necessarily result in *any* material health benefits at all. Absent a truly causal concentration-response relationship between PM and adverse health effects, the apparent relationship has no real predictive power.

Perhaps the most striking weakness in the arguments that might be martialed in support of a causal association between current levels of exposure to PM and adverse human health effects is the absence of any well-defined physiological mechanisms of toxic action that are clearly demonstrable in controlled laboratory studies.

Acute effects from PM exposure are clearly evident in laboratory animals at levels one to two orders of magnitude greater than typical ambient levels. Indeed, such effects were clearly and tragically evident among humans with underlying respiratory and cardiac disease, exposed to the excessively high levels of air pollution that occurred during the public health disasters of Donora, Pennsylvania in October 1948 and London, England in December 1952. Under such extreme conditions, the already compromised respiratory

clearance and defense mechanisms could not cope with the overwhelming burden of incoming particulate matter.

Most importantly, however, laboratory animal studies have yet to demonstrate unequivocally the effects that have been reported in humans at typical levels of human exposure. The absence of well-defined mechanisms of action and the failure to demonstrate comparable effects in controlled laboratory studies at typical levels of human PM exposure have forced the USEPA to rely on empirical concentration-response functions that may well be entirely correlative, rather than causative, in nature. Because the estimated health benefits projected to arise from the proposed new PM standards are based on unsubstantiated assumptions rather than scientific facts, they are speculative, not predictive with any substantial degree of reliability. Therefore, little confidence can be placed in their estimated values.

2. Regional monitors do not accurately portray personal exposure.

The epidemiologic studies upon which USEPA has relied are "ecologic" in design: PM exposure has been characterized in these studies not by measurement of individual personal exposures, but instead by data from stationary monitors (often just a single monitor) in specific outdoor locations in the regions studied. If causal concentration-response relationships between PM exposure and adverse human health effects truly exist, then the underlying driving variable in these relationships will be provided by each individual's personal exposure history, not by the ambient PM level as estimated from observations at fixed outdoor monitors.

The correlations between personal exposures and regional indices of PM are not likely to be uniform, strong, or consistent through time because personal activity patterns vary greatly during the day, and because much time is spent indoors where sources of PM unrelated to outdoor sources contribute heavily to personal exposure. Ozkaynak et al. (1996) recently reported results from a study conducted in Riverside, California that compared central regional sampling observations of PM with outdoor concentrations measured near individual homes, with indoor concentrations as measured by stationary indoor samplers, and with PM observations from individual samplers worn by study participants. Although outdoor PM concentrations near homes were reasonably well-correlated with the regional PM measures, indoor concentrations were only weakly correlated with outdoor concentrations, and "personal exposures were even more poorly correlated with outdoor concentrations."

If the correlations between personal exposures and regional indices of PM are weak, than little confidence can be placed in the estimated health benefits that have been

attributed to achieving compliance with the proposed new PM standards. Substantial additional effort needs to be directed towards the characterization of actual personal exposures to PM_{10}, $PM_{2.5}$, and co-pollutants. Acquisition of personal exposure histories over extended periods of time is particularly important in resolving the question of whether acute health effects are due to long-term low-level exposures or intense, short-term exposure episodes. Such data are also crucial to (1) resolution of the causation issue, (2) identification of specific air pollution constituents that may be responsible for adverse health effects, and (3) identification of the specific physiologic mechanisms by which such effects arise. Only then will it be possible to scientifically justify stricter regulation of specific air pollution constituents.

3. Control for potential confounding by co-pollutants and other factors is inadequate.

The concentration-response relationships employed by USEPA in its quantitative risk assessment of PM are essentially univariate in nature, i.e., single measures of PM, either PM_{10} or $PM_{2.5}$, have been considered one at a time in relation to the incidence of various adverse health outcomes. This limitation in the scope of the dose-response models is also a feature common to most of the epidemiologic studies upon which USEPA's risk assessment has been based; few of these studies simultaneously considered the potential effects from multiple pollutants. The failure to account explicitly for the potential health effects due to simultaneous exposure to PM and other pollutants will almost certainly lead to substantial overstatements of both the strength and statistical significance of the apparent associations of adverse health outcomes specifically with PM exposure. This point is further illustrated with several noteworthy examples below.

Moolgavkar and his co-workers have conducted a number of reanalyses of selected data sets in which additional potentially confounding co-pollutants were allowed to enter the regression models simultaneously with measures of PM. For example, fluctuations in daily mortality in Steubenville, Ohio had been previously analyzed by Schwartz and Dockery (1992a) in relation to total suspended particulates (TSP), and they reported a statistically significant association between TSP and this adverse health outcome, even after rather elaborate adjustments for the potential effects of weather. When Moolgavkar et al. (1995a) reanalyzed daily mortality for full calendar years, they concluded that:

> "... the effect of particulates was substantially attenuated when sulfur dioxide was simultaneously included in the regression, and was no longer statistically

> significant. When mortality data ware analyzed by seasons, similar results were obtained. In addition, there appeared to be seasonal effects in the association of particulates and sulfur dioxide with daily mortality. The results of the analysis were not robust to small perturbations in the data. In view of these findings, it is premature to draw any conclusions about the relationship between individual components of air pollution and daily mortality."

In a similar reanalysis of daily mortality in Philadelphia during the 1973-1988 period, Moolgavkar et al. (1995b) included consideration of a second co-pollutant, ozone, along with TSP and sulfur dioxide. A previous analysis by Schwartz and Dockery (1992b) had implicated particulate matter (specifically, TSP) as a causal factor in increased daily mortality in that city, even after inclusion of sulfur dioxide as a co-pollutant in their regression models. However, the Schwartz and Dockery analysis did not allow for differential effects by season of the year.

Interestingly, Moolgavkar et al.'s (1995b) reanalysis, which did stratify by season, found the apparent effect of TSP on daily mortality to be "greatly attenuated" when sulfur dioxide was introduced into the regression model, except during the summer quarter. Introduction of ozone as a second co-pollutant led to a similar attenuation of TSP's apparent effect in the summer quarter. Thus, appropriate allowance for differential effects by season and the simultaneous consideration of both sulfur dioxide and ozone eliminated altogether the apparently significant effect of TSP in every season.

Although Moolgavkar et al. (1995b) acknowledged explicitly that other investigators had already concluded that some subfraction of PM was largely responsible for the apparent associations of air pollution with daily mortality, they took significant exception to that view:

> "Our results in this paper do not support this conclusion. Indeed, our analysis indicates that the association between pollution and mortality is attributable to ozone in the summer and to sulfur dioxide in the other seasons."

In an even more recent analysis of the same data, Moolgavkar et al. (1997) have added a third co-pollutant, nitrogen dioxide, to their regression models. Their results indicate that while TSP, when considered alone, was a significant predictor of daily mortality in every season of the year, it failed to achieve statistical significance in any season of the year when sulfur dioxide, ozone, and nitrogen dioxide were also included in the regression models.

Finally, we call attention to one more recent reanalysis of the relationship between PM and daily mortality in Birmingham, Alabama that was conducted by Davis et al. (1996). Schwartz's (1993) previous analysis had concluded that PM_{10} was a statistically significant predictor of daily mortality after adjustments were made in the regression model for systematic seasonal and longer term time trends, potential weather confounders, expressed as daily mean temperature and a categorical variable indicating if the daily mean temperature exceeded 28°C. His analysis of these data has since been confirmed independently by Samet et al. (1995), who found no major discrepancies in Schwartz's numerical results.

Relying on previous work of their own (Styer et al. (1995)) suggesting that temperature and humidity are the most important weather variables to be considered, Davis et al. constructed a regression model that included both linear and nonlinear temperature terms, two day averages of specific humidity (current day plus preceding day, as well as the previous 2-day average), a three day average of PM_{10} measurements (current plus preceding two days), and a smooth time trend variable developed with cubic splines. The net result was a point estimate of effect for PM_{10} that was "substantially smaller than Schwartz's," with a confidence interval that did not exclude values less than one, indicating that the PM_{10} effect was not statistically significant.

Davis et al. conclude that "deciding what co-variates to put in the model" (model structure and variable selection) has the greatest impact on the results. Citing Schwartz's failure to consider humidity terms in his previous analyses, they further state that "we do not find a significant PM_{10} component in any model, except in the case when (to imitate Schwartz) we omit the humidity component." Davis et al. find the sensitivity of model results to the inclusion or exclusion of certain meteorological variables to be problematic:

> "The reported coefficients and their standard errors differ widely from one model to another, and there are no absolute grounds for choosing any one model as the 'right' model. The fact that the model selected for Birmingham is of a quite different nature from models that have been used in previous papers studying Chicago, Philadelphia and many other U.S. cities only adds to the confusion created by the confounding of meteorological effects. In our view there are enormous difficulties inherent in any claim that a variable such as PM_{10} has a consistent and statistically significant effect over a wide geographical area."

In summary, the systematic inclusion of potentially confounding variables, both weather and co-pollutants, in regression models appears to consistently reduce the

apparent effect of PM exposures on daily mortality. This behavior, which arises as a consequence of co-linearity among co-pollutants, was discussed insightfully by Lipfert and Wyzga (1995), who stated:

> "Although multiple-pollutant modeling will likely result in loss of significance of one or more species and may be biased by differential measurement errors, such results provide valuable information and should be reported. All results based on only a single pollutant should be regarded as "indices" of overall air pollution, which may or may not indicate the best candidate for control."

The USEPA quantitative risk assessment has explored the confounding variable issue, but only to a very limited extent in some of its sensitivity analyses. It has concluded that confounding is not a particularly critical issue in that effect estimates seemed to be relatively insensitive to the inclusion or exclusion of individual co-pollutants. This conclusion is at variance with the findings of the various reanalyses discussed above. The discrepancy is almost certainly due to the fact that USEPA's sensitivity analyses considered only "one-at-a-time" additions of individual copollutants. The reason for this restriction is that only a few of the original epidemiologic studies upon which USEPA has relied in developing its estimates of health effects considered copollutants at all, and then only as "one-at-a-time" additions to PM.

For example, as indicated in Tables 7.23, 7.24, and 7.25 of the Abt risk assessment, Ito and Thurston's 1995 study of short-term mortality in Chicago included only ozone in addition to PM_{10}. Kinney et al.'s 1995 study of short-term mortality in Los Angeles considered only carbon monoxide or ozone, but not both simultaneously, in addition to PM_{10}. Pope's 1994 study of short-term mortality in the summer season in the Utah Valley considered only ozone in addition to PM_{10}.

Furthermore, only one study of hospital admissions in Ontario, Canada by Thurston et al. (1994) examined the impact of inclusion of a copollutant on estimates of effect for $PM_{2.5}$. In that study, consideration of ozone in addition to $PM_{2.5}$ reduced the effect estimate for $PM_{2.5}$ by a nearly two-fold factor (from 0.086 to 0.045 cases per 100,000), and the effect of $PM_{2.5}$ was no longer statistically significant. Indeed the lower bound of the 90% credible interval was *negative*, indicating that a potentially beneficial effect of $PM_{2.5}$ exposure could not be ruled out.

Clearly, there is insufficient data at the present time to conclude that consideration of copollutants in addition to $PM_{2.5}$ would have little impact on the estimates of effect associated with $PM_{2.5}$ exposure. "One-at-a-time" consideration of co-pollutants and

various weather variables is simply not adequate to address the complex issue of confounding. "One-at-a-time" is not the way co-pollutants and weather variables occur in nature, and it is not an appropriate method for assessing the relative importance of multiple confounding variables. Such limited consideration fails to provide a sufficient scientific basis for concluding that USEPA's benefit estimates are robust to the potentially significant influences of confounding variables. The true benefits that result from compliance with the proposed new PM standards may well be completely negligible if co-pollutants and/or other confounding variables such as weather are actually responsible for the adverse health effects of air pollution.

B. Possible Threshold Forms for True Concentration-Response Relationships

In the Federal Register notice of its proposed new PM standards, USEPA has acknowledged explicitly that

> "The single most important factor influencing the uncertainty associated with the risk estimates is whether or not a threshold concentration exists below which PM-associated health risks are not likely to occur." (*Fed Reg* 61:65651)

The large degree of uncertainty in the estimated public heath benefits attributable to compliance with the proposed new standards is due primarily to two factors. First, the underlying concentration-response relationship, if in fact there truly is one, may not be log-linear, i.e., approximately linear, all the way down to the natural background PM levels, as USEPA's baseline risk assessment has assumed. It is in fact very likely that a minimum threshold level of exposure to PM exists that must be exceeded before any adverse health consequences would ensue.

Second, most days of the year have low to mid-range levels of PM, while days with high PM values, such as those associated with the 98th percentile, by definition, occur only infrequently. Unless the assumed concentration-response relationship is highly nonlinear, with disproportionately greater risks associated with high PM exposure levels, the predicted aggregate risk accumulated over an entire calendar year of daily PM exposures will be dominated by the contribution from the many days with low to moderate levels of PM. This is precisely the exposure range for which the empirically determined concentration-response relationships utilized by USEPA are most uncertain.

The Abt risk assessment has examined the impact of a threshold in the concentration-response relationships for various health effects, at least to a limited extent. Specifically, in

Exhibits 7.13 through 7.20 of the November 1996 revision to the July 1996 report, three alternative threshold levels for either PM_{10} (20, 30 or 40 $\mu g/m^3$) or $PM_{2.5}$ (10, 18, or 30 $\mu g/m^3$) were explored. Exhibit 7.16 demonstrates that existence of a $PM_{2.5}$ threshold at 30 $\mu g/m^3$ reduces the estimated "as is" impact of $PM_{2.5}$ on short term mortality in Philadelphia County during the September 1992 - August 1993 period from 1.8% of total incidence (assuming linearity) to 0.1%. This is nearly a twenty-fold reduction in the estimate of $PM_{2.5}$ effect *before* implementation of new standards. Similarly, the estimated incidence of lower respiratory tract symptoms among 8 - 12 year old children is reduced from 20% to 3.8%, a more than five-fold reduction.

Clearly, USEPA's *assumption* of log-linear concentration-response relationships for various health effects has an enormous impact on the estimated baseline incidence of those effects as well as the estimated benefits associated with implementation of the proposed new standards. However, the log-linear assumption cannot be justified. As is discussed further below, the epidemiologic studies upon which USEPA has relied do not have the statistical power to rule out the existence of threshold dose-response relationships.

That thresholds for nearly all toxic responses to chemical exposure exist has been a dominant tenet of toxicological thought since the time of Paracelsus (1493-1541), who wrote:

> "All substances are poisons; there is none which is not a poison. The right dose differentiates a poison and a remedy."

The only clear exception to this general rule of toxicological experience is the cancer endpoint. Because many cancers have been demonstrated experimentally to arise from single cells whose genetic material has been altered irreversibly by specific individual biochemical interactions with carcinogenic substances, there is now widespread scientific consensus that natural carcinogenic processes, ongoing even in the absence of exposure, can be augmented or accelerated incrementally even by extremely low levels of exposure to some carcinogenic materials.

USEPA has failed to make a convincing scientific argument that the log-linear concentration-response relationship it has assumed for the effects of PM on all health endpoints is appropriate. None of the epidemiologic studies relied upon in USEPA's quantitative risk assessment have undertaken a thorough and systematic examination of alternative nonlinear exposure-response relationships. They simply assumed a log-linear dependence of relative risk upon PM levels, often in the absence of any additional information on co-pollutants. Interestingly, in Samet et al.'s (1995) reanalysis of the Philadelphia data on acute mortality, TSP, when it was considered in combination with sulfur dioxide, was found "to have little effect on mortality until it reached 100 $\mu g/m^3$". Moolgavkar et al. (1997) have also concluded that "The data currently do

not support a linear no-threshold exposure-response relation for a particulates-mortality association."

We strongly agree with this conclusion. The assumption of a linear no-threshold concentration-response relationship is not presently scientifically justifiable. Careful prospective studies of personal PM exposures in relation to adverse health outcomes will be necessary to shed additional light on this issue. The sensitivity analysis conducted in USEPA's quantitative risk assessment using different cut points (i.e, thresholds) demonstrates the enormous impact such thresholds have on the projected benefits from proposed new standards.

Health benefits estimated with threshold-like concentration-response relationships should play a central role in USEPA's quantitative risk assessment, because they are the rule, rather than the exception, in toxicology. However, they have been assigned a secondary role in relation to the effect estimates obtained by USEPA with log-linear models. Indeed, as previously indicated, USEPA's quantitative risk assessment demonstrates clearly that concentration-response relationships with significant threshold levels lead to negligible public health benefits from the proposed PM standards.

C. Limited and Differential Accuracy of PM Measurements

Regression models of concentration-response relationships generally presume, albeit implicitly, that the independent variables are known without error. Uncertainty about the true values of these variables, or errors in their measurement, leads to an "errors in variables" problem that has no simple solutions in the general multivariate case. None of the epidemiologic studies upon which USEPA has relied in developing quantitative estimates of benefits from compliance with its proposed new PM standards have dealt effectively with the "errors in variables" problem. USEPA's quantitative risk assessment, although acknowledging this issue as an important source of uncertainty, also fails to deal effectively with it. It may well be that this difficulty can only be resolved with further prospective study involving adequate simultaneous measurements of both individual PM exposures and region-wide measures of air quality.

Lipfert and Wyzga (1995) have discussed several aspects of this problem in considerable detail. One very important issue relates to the fact that air pollution is a mixture of well-correlated co-pollutants that are not all measured with the same precision. It may be, for example, that one particular component is primarily responsible for adverse health effects, but that this component is measured only with considerable error. Another component, highly correlated with the first, but not causally related to adverse health effects, might be measured with far greater precision. Lipfert and Wyzga have shown that when regression models are developed with such variables entered individually, they may each appear to be highly statistically significant.

More importantly, however, when these variables are entered simultaneously into a

regression model, the variable with greater measurement error may lapse into nonsignificance even though it is the true underlying causal variable, while the variable with the smaller measurement error may remain highly statistically significant, even though it is just a highly correlated, non-causal confounder. Differentials in the reliability of exposure estimates can thus lead to invalid inferences with regard to the underlying causal variables. It is therefore essential that USEPA give full and careful consideration to the consequences of the measurement error that are known to exist in the independent variables used in its regression models. This has not been accomplished in the current proposal.

V. CONCLUSIONS AND RECOMMENDATIONS

In developing its quantitative risk assessment of potential health benefits from its proposed new PM standards, USEPA has relied on epidemiologic studies with significant methodologic limitations. Chief among these is the failure of these studies to have determined individual personal exposure levels that might be directly linked to adverse health outcomes. The absence of personal exposure data has forced the Agency to rely on correlative "ecologic" studies relating regional indices of PM exposure to population indices of morbidity and mortality. However, correlation is not causation. If the association between estimated PM exposure and adverse health consequences is solely, or even partly, due to factors other than PM_{10} or $PM_{2.5}$ that happen to have co-varied historically with both the PM levels and the incidence of adverse health effects in the past, then future reductions in specific PM levels need not necessarily result in *any* material health benefits. USEPA needs to acknowledge this fundamental and critical limitation of its risk assessment.

The correlations between personal exposures and regional indices of PM are not likely to be uniform, strong, or consistent through time because personal activity patterns vary greatly during the day, and because much time is spent indoors, where sources of PM unrelated to outdoor sources contribute heavily to personal exposure. If the correlations between personal exposures and regional indices of PM are weak, then little confidence can be placed in the estimated health benefits that have been attributed to achieving compliance with the proposed new PM standards. Further study is required to clarify the causation issue, to identify specific constituents of air pollution that may be responsible for adverse health effects, and to identify specific physiologic mechanisms by which such effects arise. Only then will it be possible to scientifically justify stricter regulation of specific air pollution constituents.

The concentration-response relationships employed by USEPA in its quantitative risk assessment of PM are essentially univariate in nature, i.e., single measures of PM, either PM_{10} or $PM_{2.5}$, have been considered one at a time in relation to the incidence of various adverse health outcomes. This limitation in the scope of the independent variables included in the concentration-response models is also a feature common to most of the epidemiologic studies upon which USEPA's risk assessment has been based; few of these studies simultaneously considered the potential effects from multiple pollutants. The failure to account explicitly for the potential health effects due to simultaneous exposure to PM and other pollutants almost certainly leads to substantial overstatements of both the strength and statistical significance of the apparent associations of adverse health outcomes specifically with PM exposure.

The USEPA quantitative risk assessment has explored the confounding variable issue to a very limited extent in some of its sensitivity analyses. It has concluded that confounding is not a particularly critical issue in that effect estimates seemed to be relatively insensitive to the inclusion or exclusion of individual co-pollutants. This conclusion is at variance with the findings of the various reanalyses discussed above. The discrepancy is almost certainly due to the fact that USEPA's sensitivity analyses consider only "one-at-a-time" additions of individual co-pollutants. This is not the way co-pollutants occur in nature, and it clearly does not provide a sufficient scientific basis to conclude that USEPA's benefit estimates are robust to the potentially significant influences of confounding variables. The true benefits that result from compliance with the proposed new PM standards may be completely negligible if co-pollutants or inadequately addressed weather variables are indeed responsible for the adverse health effects of air pollution.

The large degree of uncertainty in the estimated public heath benefits attributable to compliance with the proposed new standards is due primarily to two factors. First, the underlying concentration-response relationship, if there actually is one, may not be log-linear, i.e., approximately linear, all the way down to the natural background PM levels, as USEPA's baseline risk assessment has assumed. It is likely that a minimum threshold level of exposure to PM exists that must be exceeded before any adverse health consequences might ensue. Second, most days of the year have low to mid-range levels of PM, while days with high PM values, such as those associated with the 98th percentile, by definition, occur only infrequently. Unless the concentration-response relationship is highly nonlinear, with disproportionately greater risks associated with high PM exposure levels, then the aggregate risk accumulated over an entire calendar year of daily PM exposures will be dominated by the contribution from the many days with low to moderate levels of PM. This is precisely the exposure range for which the empirically determined log-linear concentration-response relationships employed by USEPA are most uncertain.

The assumption of a no-threshold concentration-response relationship is unproven and not scientifically justified. Careful prospective studies of personal PM exposures in relation to adverse health outcomes are prerequisite to establishing the existence of such a relationship.

The sensitivity analysis conducted in USEPA's quantitative risk assessment using different cut points (i.e, thresholds) demonstrates the enormous impact such thresholds have on the relative significance of projected benefits from proposed new standards. Benefits estimated with threshold-like concentration-response relationships should play a central role in USEPA's quantitative risk assessment rather than the secondary role they have been assigned in comparative sensitivity analyses. Reliance of the primary estimates upon log-linear models is unjustified.

Regression models of concentration-response relationships generally presume, albeit implicitly, that the independent variables are known without error. Uncertainty about the true

values of these variables, or errors in their measurement, leads to an "errors in variables" problem that has no simple solutions in the general multivariate case. None of the epidemiologic studies upon which USEPA has relied in developing quantitative estimates of benefits from compliance with its proposed new PM standards have dealt effectively with the "errors in variables" problem. USEPA's quantitative risk assessment, although acknowledging this issue as an important source of uncertainty, also fails to deal effectively with it. This difficulty can only be resolved with further prospective study involving adequate simultaneous measurements of both individual PM exposures and region-wide measures of air quality.

Faced with such great uncertainty as to not only the magnitude but even the existence of potential health impacts of the proposed new standards, it would seem far more reasonable that USEPA initiate additional data collection activities on the various PM fractions rather than rush to promulgate and implement scientifically unjustified new standards.

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COMMENTS TO USEPA ON THE PROPOSED NATIONAL AMBIENT AIR QUALITY STANDARDS FOR PARTICULATE MATTER:
Issues of Causality

on behalf of
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I. EXECUTIVE SUMMARY

In the Proposed Decisions on the National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM) the US Environmental Protection Agency (USEPA) concludes that two new primary $PM_{2.5}$ standards should be added to the existing PM NAAQS based on the judgment that $PM_{2.5}$ is causally related to increases in death (mortality) and respiratory illness or symptoms (morbidity). Despite the Agency's observation that individual studies are limited for addressing questions of causality, they concluded that the "*consistency and coherence of the evidence across the studies*", along with the "*relatively small ranges of variability in the effects estimates observed in these studies*" evaluated "*are consistent with expectations based on assuming causal relationships between mortality and morbidity effects and PM exposure*".

On behalf of Kennecott Corporation, ENVIRON has conducted a critical review of the data relied upon by USEPA to reach its conclusions. We disagree with the Agency, as do the chair of USEPA's Clean Air Science Advisory Committee (CASAC) and other respected and impartial members of the scientific community, in that we do not believe that the Agency has developed scientifically credible NAAQS. There are two reasons for this conclusion: (1) the qualitative attribution of causality has not been clearly established, and (2) because of the uncertainties in the estimation of potential risk from current ambient air pollution, USEPA's risk assessment does not demonstrate that a reduction in $PM_{2.5}$ levels will indeed save lives or prevent disease[1].

When determining causality, expert judgment is applied to both individual studies and the entire data base. In our scientific review, we first determined whether individual epidemiologic studies were free from bias and confounding by evaluating whether potentially confounding variables such as copollutants (e.g., ozone, SO_2, H_2SO_4, NO_x, volatile organics, and metals), and weather conditions (i.e., temperature, season, relative humdity) could explain the reported observations. We also evaluated the degree to which exposures were accurately classified and measurements of pollutants were error-free.

Then, using the widely accepted Bradford Hill criteria, the data base as a whole was evaluated to determine whether the conditions for causality were met. The criteria include *temporality* (whether effects follow exposures), *consistency* (whether the same extent of response is noted across different geographic regions and population groups), *biological plausibility*

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[1]The former is the subject of this submission; the latter is commented upon in ENVIRON's accompanying remarks on the Quantitative Risk Assessment.

(whether a toxicological mechanism can be proposed to account for the observed effects), and *coherence* (whether the same effects are noted across different studies).

When associations between exposures and outcomes are strong, i.e., when relative risks are high, attribution of causality is relatively straightforward. When the association is weak, however, as in the case of PM, sound science requires that more emphasis be placed on making certain that the quality of the studies and their subsequent analyses meet minimal standards (i.e., reproducibility), and that the observed associations between exposures and outcomes be biologically plausible.

The PM data base does not meet the standard required to make a causal attribution. This conclusion is based on the following observations:

- The strength of the association between measures of air pollution, or any component of air pollution and adverse health outcome is very weak (relative risk ranges from approximately 1.06 to $\leq$ 1.5).

- Significant uncertainties exist in estimates of exposure. In particular, the ecological fallacy, which states that measures of population exposure can not be used to determine individual exposures, is clearly in effect because estimates of exposures in all of the studies are derived from community samplers, not individual monitors. It is therefore impossible to determine whether individuals who die or experience health problems are actually exposed to the air masses measured by these sampling devices.

- Because $PM_{2.5}$ is a mixture of different chemical species arising from volatilized materials, PM precursors are not only sources, but also copollutants in contemporary air pollution. When the role of these copollutants is carefully considered, measures of PM-associated risk decrease, often to insignificance. Other pollutants (e.g., ozone, SO_2, H^+, CO, and NO_2), however, often maintain a significant association with adverse health outcomes. Thus the consistency and coherence criteria are not satisfied.

- Although exposures to high levels of pollutants have clearly caused death and respiratory distress in the past, there is no compelling biological or toxic mechanism that can explain the adverse health outcomes noted for current PM levels. Much research has been conducted to identify such mechanisms, but to date, no scientifically-defensible argument can be proposed to account for the effects observed in people exposed to current levels of air pollution.

The regulatory implications of the inability to attribute causality to PM are critical: if PM in general, or $PM_{2.5}$ specifically, is not responsible for these adverse health effects, imposing new NAAQS, and the control strategies required for compliance will not decrease the risk(s) attributed to particulates. Based on current knowledge, it is not clear that decreasing levels of $PM_{2.5}$ would save lives or avoid diseases.

At this time, we believe that USEPA should not revise the PM NAAQS but rather immediately implement a targeted research program to address the incomplete data base on $PM_{2.5}$ and uncertainties regarding key issues in causality attribution and the subsequent estimation of risk from PM. This recommendation is consistent with CASAC's position.

In particular, the Agency's reliance on the apparent consistency and coherence of the data must be reevaluated in light of the careful and rigorous reanalyses of the key studies that contradict those judgments. By the next cycle of criteria pollutant review, sufficient data should be available to determine whether additional control strategies for particulates, or other pollutants, should be implemented to minimize public health risks.

Given the continually decreasing levels of air pollution in the US, we do not believe that this delay will increase risk; in fact, by virtue of its increased precision, it will provide a more certain opportunity to improve the public health.

II. INTRODUCTION

In the Proposed Decisions on the National Ambient Air Quality Standards (NAAQS) for Particulate Matter (PM) issued on 13 December 1996, the US Environmental Protection Agency (USEPA) concludes that the current primary standard for PM_{10} should be changed to provide increased protection against a wide range of "PM-related" health effects by the addition of two new primary $PM_{2.5}$ standards (at annual and 24-hour mean concentrations of 15 $\mu g/m^3$ and 50 $\mu g/m^3$, respectively). In addition, the Agency proposed to revise the current primary 24-hour standard for PM_{10} (150 $\mu g/m^3$) by revising its form, but maintaining the current annual primary PM_{10} standard of 50 $\mu g/m^3$.

We note the difficulty of reviewing, interpreting, and proposing regulations on the large and complex body of health effects data associated with low-level exposures to particulate air pollutants within a judicially-mandated time frame that is insufficient to allow for deliberate consideration and the peer-review necessary to develop scientifically-defensible NAAQS. In addition to studies in the primary literature, sophisticated analytical approaches have been developed to address the intertwined issues presented by the complex mixtures comprising contemporary air. These also require careful consideration and rigorous peer-review prior to the imposition of new standards.

Although acknowledging that uncertainties exist, the Agency has concluded that there are increased risks of acute and chronic adverse health effects following exposure to PM at levels currently found in ambient air, especially from fine particulates ($PM_{2.5}$). Further, the Agency concludes that although individual studies are inherently limited as a basis for addressing questions of causality, the "*consistency and coherence of the evidence across the studies*", along with the "*relatively small ranges of variability in the effects estimates observed in these studies*" evaluated "*are consistent with expectations based on assuming causal relationships between mortality and morbidity effects and PM exposure*" (61 FR 241, p. 65646).

The key health effects that have been associated with exposures to contemporary ambient air pollution levels have been divided into increased risks of mortality, morbidity, and altered measures of lung function; they can further be divided into effects noted following short-term (i.e., acute) or long-term (i.e., chronic) exposures to ambient levels of air pollution found in US urban airsheds. Although voluminous, the epidemiologic data base on which the conclusions regarding contemporary air pollution levels rests consists of time series or cross-sectional studies that are ecologic in nature (i.e., measures of exposure are for municipal regions (e.g., cities and zip code areas) and the populations contained within them) and do not contain individual

measures of exposure[2]. What is particularly notable about this rather extensive body of studies, however, is despite the apparent consistency and coherence referred to by the Agency, the magnitude of effect (or strength of association) is extremely weak, even by the contemporary standards of epidemiologists more accustomed to evaluating "less obvious" risks.

In fact, it is the weakness of the association, the complex mixture of pollutants to which exposures occur, and the inability to accurately identify individual exposures, that require consideration of hypotheses alternative to those concluding that current ambient levels of PM are causally associated with adverse health outcomes. USEPA's Clean Air Scientific Advisory Committee (CASAC) has commented in print (Wolff 1996) on the accelerated pace and inadequacy of the scientific assessment and peer-review of the relevant studies of PM. CASAC has recommended against increasing the stringency of the $PM_{2.5}$ NAAQS, because the goal of achieving a scientifically-defensible NAAQS had not been achieved (Wolff 1996).

We concur with CASAC and disagree with USEPA's position that there is sufficient evidence at this time to attribute a causal association between exposure to contemporary levels of particulate matter, especially $PM_{2.5}$, and the adverse health outcomes cited by the Agency. The regulatory implications of the uncertainty and consequent inability to directly attribute causality are critical: if it is not particulate matter, or $PM_{2.5}$ specifically, that is responsible for the consistent effects noted, imposing control strategies for these agents will not result in the amelioration of the public health risk(s) attributed to particulates. In the following set of comments, we present our reasons for this opinion. We also direct the Agency's attention to another submission to the docket by Greenberg et al. (1997), in which an expert panel of epidemiologists address the issue of causality, and our comments (ENVIRON 1997, attached) in which we address the quantitative risk assessment employed by the Agency in proposing the new PM NAAQS.

[2]Although the three cohort studies of air pollution (i.e., the Harvard 6-Cities study (Dockery et al. 1993), the California Seventh Day Adventist study (Abbey et al. 1991, 1993, 1995), and the American Cancer Society study (Pope et al. 1995), incorporate some individual lifestyle data such as smoking, they also imply that central measurements of air pollution are valid for individual cases (see discussion of ecologic fallacy in Section III).

III. ARGUMENTS FOR CONSIDERATION OF ALTERNATIVE INTERPRETATIONS

As previously stated, the weakness of the association between measures of PM exposure and the adverse health outcomes cited as resulting from those exposures casts doubt on the attribution of causality to PM. Although the identification of the limits that bound "weak" associations is open to some debate, relative risks between 3 (Wynder 1987) and 2 (Greenberg et al. 1997) are considered weak; those less than 2 as very weak. The importance of weak association is that the closer the risk ratio is to one, "*the more likely it is that choice of the comparison standard, bias, confounding, or inappropriate analysis may explain it, and the greater the need for thorough understanding of the underlying biological mechanisms*" (Wynder 1987). In other words, where measures of risks are high, more reliance may be placed on the attribution of causality to a specified exposure. For example, the relative risk for lung cancer of heavily exposed occupational cohorts of chrysotile asbestos workers is 11.8; workers engaged in the manufacture of polyvinyl chloride have relative liver cancer risks of 12 (Monson 1990). At the opposite end of the spectrum, however, where associations are weak (i.e., < 2), confidence may be placed in the outcome measures when endpoints are congruent with predicted biological effects, and meet the Hill criteria of biological plausibility and coherence. The absence of such congruence requires that the question "How certain are we that the correct causative agent has been identified?" be asked. As stated by USEPA (1996b) and many others, (Wilson and Spengler 1996, Wolff 1996) although the measure of relative risk is small, the public health implications of these associations (if correct) are significant, given the number of people exposed.

In the following, we have illustrated some of the contributing factors to the weakness of outcome, including the potential for confounding resulting from uncertainties in exposure characterization (e.g., chemical differences in the composition of contemporary air pollution) and measurement uncertainty (i.e., the ecological fallacy). This serves as a preface to reviewing USEPA's conclusions regarding causality for PM at current ambient levels in the context of the Hill criteria for causation. As several comprehensive reviews of the key studies have recently been published, including USEPA's Air Quality Criteria Document for Particulate Matter (USEPA 1996a) and the Staff Paper on which many of USEPA's conclusions are based (USEPA 1996b), we have not repeated study descriptions here, and refer to the primary literature or reanalyses as appropriate.

A. Compositional Issues: Potentially Confounding Roles for Co-pollutants

Particulate matter is not a discrete chemical entity; rather, airborne PM is a heterogenous mixture of many different chemical species arising from different sources. Fine mode particles (i.e., $PM_{2.5}$) are generally derived either from volatilized materials that have condensed to form primary particulates, or from precursor gases that undergo chemical reactions or condense onto existing particulates while suspended in the atmosphere. Precursors of fine mode particles include sulfur dioxide (SO_2), nitrogen oxides (NO_x), and some organic compounds. Secondary PM is derived from the reactions of hydroxyl (OH), ozone (O_3), and hydrogen peroxide (H_2O_2) with the precursors during periods of relatively high temperature and sunlight, or in fog. Coarse mode particles result from nonanthropogenic sources (e.g., pollen and sea spray), the breakdown of crustal matter creating fugitive dust, and other anthropogenic activities including farming, mining, and construction.

In general, under low relative humidity conditions, particles with diameters smaller than 1 μm are considered fine mode particles, and particles with diameters greater than 2.5 μm are contained in the coarse mode fractions. When the relative humidity is high, however, waters of hydration increase the apparent diameter of particles to such an extent that particles whose original mean mass diameters measured less than 1 μm are found in the small size tail of the coarse fraction (i.e., $PM_{2.5}$ or larger) . Thus, emissions from identical sources may "mature" into very different particle size distributions depending on weather conditions over geographical regions, and adjusting for relative humidity to more accurately measure exposure may have a significant impact on risk measures.

Several investigators have attempted to control for the effects of weather with varying degrees of success (HEI 1995, 1996), Moolgavkar and colleagues (1995a,b, 1996, 1997), Wyzga and Lipfert (1995a). Noted in their studies has been the dependence of outcome measures on the manner in which weather variables such as temperature and humidity covary with pollutants and thus contribute to the apparent correlation between exposure and outcome. For example, although mortality varies seasonally in all climates (Lipfert and Wyzga 1995a), the introduction of air pollutants into seasonal mortality evaluations adds complexity because the relative prevalence of pollutants differs among seasons in temperate climates (e.g., high levels of CO in winter and high levels of ozone in summer). The potentially confounding effects of weather and season have been demonstrated by Moolgavkar and his colleagues (1995a,b) and HEI (Phase 1) as attenuators of significance for some combinations of pollutants (e.g., PM, SO_2), and persistence of effects for others (e.g., ozone in Minneapolis (Moolgavkar 1997)) for hospital admissions as measures of morbidity.

Recently, Davis et al. (1996) have reconstructed the mortality data for Birmingham, Alabama reported by Schwartz (1993), and performed an independent analysis incorporating alternative modeling strategies. When considering three-day PM_{10} averages, some of their results were in substantive agreement with those presented by Schwartz, i.e., a statistically significant association between PM_{10} exposure and mortality outcome. However, this result appears to be highly sensitive to the form of the model used to perform the analysis. When all the model uncertainties were considered, incorporation of terms accounting for relative humidity resulted in disappearance of the significance of the PM_{10}- morbidity outcome. Whether the attenuation of effect measure is an artifact of model specification, or an accurate descriptor of the influence of meteorological conditions on potential risk is not clear. Nonetheless, the observations of Davis et al. are consistent with those reported by other investigators (Moolgavkar et al. 1995, 1996, Lipfert and Wyzga 1996a,b), and imply that there is a significant potential for weather conditions to confound potential associations between pollutants and measures of mortality or morbidity.

In addition to the role of temperature and relative humidity, it is clear that fine particles ($PM_{2.5}$) arise, in part, from reactions of precursor gases many of which persist in urban airsheds and contribute to the total exposures experienced by the populations evaluated in the epidemiologic studies. $PM_{2.5}$ precursors are thus not only sources, but also covariates in these analyses.

Attempts have been made by original investigators (reviewed by HEI 1996a, Lipfert and Wyzga) as well as individuals (Moolgavkar et al. 1995a,b, 1996, 1997. Lipfert and Wyzga 1995a,b) and organizations (HEI 1995) to dissect the potential confounding effects of colinear pollutants and differential measurement error from PM. Chief among these are reanalyses of parts or all of the Six City study (Dockery et al. 1993), especially Philadelphia and Steubenville (Moolgavkar and colleagues, 1995, 1996; HEI 1996a,b). In many cases the associations between ozone, sulfur dioxide, or carbon monoxide and adverse health outcome can be as important, or even more important than PM measured in total or as a mass fraction. These studies have shown that in most cases, when attempts are made to include more than one pollutant in multiple regression analyses, the effects of PM (or PM_{10} or $PM_{2.5}$) attenuate, and different pollutants appear to retain robustness of association.

For example, in the first of his series of reanalyses, Moolgavkar et al. (1995a) revisited the Steubenville component of the study reported by Schwartz and Dockery (1992) with two goals: (1) to replicate the published findings; (2) to reanalyze the data set after considerations of various data recombinations. Schwartz and Dockery had reported that PM was significantly associated with daily mortality in Steubenville, with the association persisting even after adjustments for the

effects of weather, with no attenuation of the magnitude of effect when PM and sulfur dioxide were considered simultaneously.

Moolgavkar and his colleagues collected Steubenville daily death data from mortality tapes of the National Center for Health Statistics for the years 1974-1984 inclusive. Deaths due to accidents were excluded, leaving two distinct data sets for analysis: (1) "total" mortality, which represented all deaths (excluding accidents) occurring in Steubenville; and (2) "restricted" mortality, which included all deaths (excluding accidents) occurring in the area defined as Steubenville in individuals classified as Steubenville residents. Moolgavkar et al. point out that it is not clear which mortality data set was used by Schwartz and Dockery, despite personal communication from Schwartz that restricted mortality was employed. Daily weather information and air pollution data were in good agreement with that used by Schwartz and Dockery.

Statistical analysis of the data sets also differed. Although Moolgavkar et al. employed the generalized estimating equation (GEE) approach used by Schwartz and Dockery, they also evaluated a number of Poisson regression models. The latter method resulted in similar parameter estimates but different standard errors and confidence intervals when compared to the results obtained by the GEE approach of Schwartz and Dockery.

The differences in errors and confidence intervals led Moolgavkar et al. to alternative interpretations of the data. For example, reanalysis of the full-year (all seasons) data, with TSP as the only covariate, resulted in a significant association with mortality using a one day lag, with a relative risk per 100 $\mu g/m^3$ of 1.029 (95% CI = 1.007-1.051); this result was in good agreement with that reported by Schwartz and Dockery (1992). However, Moolgavkar et al. found that including both TSP and sulfur dioxide reduced the TSP effect to a level that was no longer statistically significant. Schwartz and Dockery's findings of a significant TSP effect regardless of inclusion of sulfur dioxide in the model could only be reproduced if GEE methods and the continuous monitoring data sets for sulfur dioxide were used. Because Schwartz and Dockery (1992) acknowledge that the continuous monitoring data set was flawed due to measurement problems, Moolgavkar et al. questioned the validity of the previous investigators' findings.

When the Steubenville data were reanalyzed by season, inclusion of sulfur dioxide as a covariate again attenuated the effects of TSP on mortality. Mortality was significantly affected by temperature, with the highest mortality observed in the lowest quintile of temperature (the coldest days of fall and winter); mortality also appeared to increase in the highest quintile of temperature (i.e., summer), although the result was not significant. Schwartz and Dockery found winter and spring mortality to be significantly higher than that in the fall and summer.

Moolgavkar et al. interpret their own findings as demonstrating a lack of robustness in the inferences drawn from the previous analysis of the Steubenville data. They cite the dependence of

outcome on model selection (i.e., Poisson or GEE) and the fact that weather and pollution variables explain only a small fraction of the daily deaths as a sensitivity of the analyses to measurement errors. Their interpretation of their own findings is that the Steubenville analyses are "*consistent with weak associations between weather and air pollution and mortality.*" Further, they caution that "*in view of the instability of the results, consistency with the results of analyses in other cities must be sought before any firm conclusions can be drawn.*" As a result, although they observed an association between air pollution and daily mortality, Moolgavkar and his colleagues concluded that singling out one particular component of air pollution (e.g., TSP) as responsible for the observed increase in mortality would be premature.

In a second study, Moolgavkar et al. (1995b) reanalyzed the data for Philadelphia originally studied by Schwartz and Dockery (1992b). Information on all daily deaths in Philadelphia, excluding accidents and suicides, was obtained from mortality tapes of the National Center for Health Statistics for the years 1973 to 1988 (inclusive). In contrast, Schwartz and Dockery excluded deaths among individuals who commuted daily into the city for jobs and died there. Deaths were examined in a full-year analysis, as well as in a seasonal analysis. Moolgavkar and his colleagues extended the years of observation from 8 to 16 years, thus nearly doubling the size of the data base. Air pollution data on TSP, sulfur dioxide, and ozone were obtained from EPA's Aerometric Retrieval Service, with average daily readings from all of the monitoring stations used in the analysis. Like Schwartz and Dockery, Moolgavkar et al. employed Poisson regression methodology to evaluate the degree to which the previous day's pollution variables (TSP, sulfur dioxide, ozone) were associated with the daily mortality.

Moolgavkar et al. found that when TSP and sulfur dioxide were examined individually, each was associated significantly with mortality, regardless of the season. Ozone, however, was associated with mortality only in the summer. When pairs of pollution covariates were evaluated, the effects of TSP were markedly attenuated by the addition of sulfur dioxide to the analysis. TSP effects were also attenuated in the summer when ozone was considered. In contrast, the association of sulfur dioxide with daily mortality persisted in spring, fall, and winter, even when TSP or ozone was included as a covariate. When all three pollution covariates were considered simultaneously, the association of ozone with mortality persisted in summer with a relative risk of 1.15. Similarly, the association of sulfur dioxide with mortality persisted in spring, fall, and winter. TSP was non-significant in all seasons; although the confidence intervals widened, relative risks remained essentially unchanged. Moolgavkar et al. indicate that when they evaluate data for Philadelphia residents only, as did Schwartz and Dockery (1992b), similar findings resulted.

Thus, Moolgavkar and his colleagues found that the association between air pollution and mortality in the Philadelphia cohort study is partly attributable to ozone in summer and to sulfur

dioxide in the other seasons, but not to particulates, and commented on the consistency of this conclusion with their reanalysis of the Steubenville data, which also failed to support the particulate mortality hypothesis. They conclude by stating that "*a specific component of air pollution cannot be singled out as being responsible for the association between air pollution and mortality.*"

In a review of the key studies of urban airsheds that have examined the relationship between particulate air pollution and mortality, Moolgavkar and Luebeck (1996) report having been "*struck by the fact that most of the epidemiologic studies have focussed on the particulates and sulfur dioxide to the exclusion of other pollutants.*" They further indicate that although the majority of the epidemiologic studies are not inconsistent with association between particulates and mortality, this association currently exists in the absence of biological plausibility, because the toxicologic data from laboratory animal experiments or controlled human exposures, even at levels significantly higher than the NAAQS, do not result in adverse health effects attributable to particulates. Moolgavkar and Luebeck then conclude their review by stressing the importance of identification of the biological mechanism(s) behind the effects, and caution that the very weak associations put forward by others in the face of potentially confounding copollutants and seasonal influences preclude establishing a causal relationship between particulate exposure and increased mortality at the present time.

In a second group of studies (HEI 1995), in response to interest from the regulatory, industrial and environmental communities, HEI sponsored an independent and objective review of the data supporting suggestions that exposures to PM may cause increased mortality and morbidity from respiratory and cardiovascular diseases. Data sets were submitted by the original investigators of the selected studies (i.e., Dockery, Fairley, Pope, and Schwartz); Moolgavkar joined the study at a later stage and supplied the data sets that he employed in his reanalyses of Philadelphia mortality. Phase 1 was designed to replicate the results from six key studies and to test the sensitivity of the original results to alternative analytic approaches; Phase 2 will extend the reanalysis to a broader group of studies and focus on the public health implications of the impact of PM on lost years or quality of life; it is currently underway.

In Phase 1, the HEI-sponsored team attempted to (1) reconstruct the data base for the Philadelphia mortality study of Schwartz and Dockery (1992a) for the years 1973-1988 and to confirm the findings of the original investigators; (2) develop an overall strategy for reanalysis and interpretation of data from the other studies based on the reanalysis of the Philadelphia data; (3) apply the new analytical strategy to individual data sets from mortality studies of Philadelphia, Utah Valley, St. Louis, Eastern Tennessee, Birmingham, and Santa Clara; and (4) complete a

sensitivity analysis of alternative modeling strategies and approaches for the consideration of potential confounders (e.g., weather).

The Philadelphia study was selected because of the apparent inability of two independent, well-respected groups of investigators (Li and Roth (1995) and Moolgavkar et al. 1995b) to reproduce the original results reported for that study. One hypothesis for the failure to replicate findings was that use of different, but partially overlapping data sets by the different groups (e.g., Moolgavkar et al. analyzed 8 more years of data than Schwartz and Dockery) may have contributed to quantitative (and in some cases, qualitative) differences in outcomes.

Using the same publicly available data bases employed by the original investigators, the HEI-sponsored team were able to reconstruct a data set for weather and mortality that closely matched that of Schwartz and Dockery. Likewise, the HEI team were able to fairly closely reconstruct the data set developed by Moolgavkar et al., although, for reasons that are not clear, the match for reconstructed mortality data was less close. In addition, the reconstructed air pollution data differed somewhat from the TSP data of Moolgavkar et al. and the SO_2 data of Schwartz and Dockery (i.e., when analyzing Moolgavkar et al.'s data set, the coefficient for TSP was 30 percent lower than that reported by the original investigators). These minor differences had little impact on the conclusions drawn by the HEI team, close agreement with the findings of both the original investigators and Moolgavkar et al. resulted, with only minor differences in the magnitude and statistical significance of the association between TSP and increased mortality in the presence of SO_2. The HEI-team noted that simultaneous consideration of TSP and SO_2 in the original data set resulted in an approximately 40 percent decrease in the magnitude of the TSP effect, with persistence of its statistical significance. Moreover, analysis of the original data set indicated higher mortality following exposure to both TSP and SO_2 for people over the age of 65, consistent with the hypothesis that the acute effect of PM on mortality may be due to the exacerbation of preexisting disease in people with compromised health (Spix et al. 1993; Seaton et al. 1995, see discussion of Biological Plausibility).

The HEI-team developed a statistical approach to test the association of daily mortality with daily air pollution and weather variables. This technique, the iteratively weighted and filtered least-squares (IWFLS) model, is capable of evaluating the primary association of interest (i.e., mortality vs. indices of PM), while controlling for the potential confounding effects of weather, and adjusting for potential overdispersion and autocorrelation of dispersion variables. (Overdispersion refers to the presence of a greater than expected variance in mortality counts when evaluated with the Poisson model; autocorrelation refers to the likelihood of two or more consecutive days having similar air conditions.) The IWFLS model produced no important

difference in effect estimates relative to those obtained by the more standard models employed by the original investigators.

Application of the IWFLS model to the other five-city data sets yielded results in close agreement with those from the earlier analyses (e.g., that positive associations were observed between exposures to TSP and daily mortality in all six locations; statistical significance was observed in all but Eastern Tennessee). It also confirmed Moolgavkar et al.'s observations that the effects of TSP and SO_2 on mortality had seasonal components, with TSP exerting more profound effects in summer and fall, and SO_2 in the winter and spring.

Thus, the HEI reanalysis of data from six locations in the US as part of Phase 1 indicates that daily mortality, whether from cardiovascular and respiratory causes, or from all causes combined, increases with increasing levels of particulate air pollution. Unlike Moolgavkar et al.'s overall findings, HEI's more detailed analysis for Philadelphia suggests that the association between air pollution and mortality "*represents an independent effect of particles alone.*" Because particulate air pollution was measured as TSP, it is not possible to further differentiate the portion of the particulate distribution (i.e., PM_{10} or $PM_{2.5}$) most likely responsible for such an effect.

Recently, HEI issued an abstract in draft form (HEI 1996), outlining the results of their Phase "1B" analysis of the Philadelphia data which differs from Phase 1 in that it is an independent analysis of the data from 1974-1988 rather than a validation of the data sets and analytical methodology employed by the original investigators and Moolgavkar et al. (1995b).

Using the statistical methodology developed as part of Phase 1, the HEI team evaluated the data on TSP, carbon monoxide (CO), SO_2, NO_2, and O_3 in the context of weather trends to determine potential effects on mortality for the city of Philadelphia. Their results indicate that the concentrations of TSP, SO_2, NO_2, and CO were moderately correlated with each other over time; mortality was significantly increased on the same and following day when levels of TSP, SO_2, and O_3 were increased; and that when considered individually, increased exposures to TSP and ozone yielded statistically significant increases in mortality. When TSP and SO_2 were considered simultaneously, however, the response to both pollutants attenuated, and neither pollutant exhibited a statistically significant association with increased mortality. When all pollutants were considered simultaneously, significant associations were found for exposures to SO_2 and ozone, and the effect of TSP, slightly lower than when evaluated individually, was marginally significant. When the data were stratified by season, age group (< 65 years, 65-74 years, and ≥ 75 years), and cause of death (i.e., total, cardiovascular, respiratory, and residual causes), the HEI team discovered that TSP exerted the strongest effect in the spring and summer, although ozone appeared to have the most effect in winter and fall when all pollutants were considered together.

The oldest age category appeared to be the most sensitive group to effects of TSP. They further determined that ozone consistently appeared to be statistically significantly associated with each cause of death category for all age groups.

Based on this analysis, HEI concluded that "*a single pollutant...cannot be readily identified as the best predictor of mortality.*" They further concluded that results of regression models based on data from single locations could not be used to determine the effects of an individual pollutant on mortality; rather, it would be necessary to assess effects across locations having differing pollutant mixtures. Phase 2 of the HEI-sponsored analysis will simultaneously consider multiple air pollutants in other cities; we await its results with interest.

The results of the Phase 1B analysis differ from those of Phase 1 in that the only pollutant that appeared to have an independent effect on mortality is ozone; PM as measured by TSP, SO_2, or CO could each contribute to the adverse health outcome, but do not appear to be acting independently, possibly because of the degree to which levels of these pollutants are correlated. Nonetheless, the HEI team's preliminary conclusions support the existence of associations between air pollution, particulates, and increased mortality, although their studies had not so far provided additional clarity on the specific particulates that may be causally involved in toxicity.

In addition to the Moolgavkar set of studies, we have previously discussed the reanalysis of morbidity and mortality in Birmingham by Davis et al. (1996) in which accounting for increases in relative humidity attenuated the effect of PM_{10}. Schwartz had reported an increase in hospital admissions for pneumonia and chronic obstructive pulmonary disease (COPD) associated with PM and less strongly associated with ozone (Schwartz 1994a). In a related study, he found that admissions for pneumonia and COPD were associated with both PM_{10} and ozone air pollution in Minneapolis-St. Paul (Schwartz 1994).

Moolgavkar et al. (1997) have also revisited these data sets to determine the effects of copollutants and weather on hospital admissions for COPD and pneumonia in the elderly. Pollutants considered by Moolgavkar et al. included PM_{10}, SO_2, NO_2, O_3 and CO (Minneapolis-St, Paul) and PM_{10}, O_3 and CO in Birmingham. After adjusting for temperature, day of the week, season, and temporal trends, little evidence was found to associate air pollution and hospital admissions in Birmingham. In contrast, hospital admissions in Minneapolis-St. Paul were associated with air pollution components. Among these, O_3 was most significantly associated with admissions, with a 5.15% (CI= 2.36-7.94%) increase per 15 ppb increase in ozone level. The authors consider this association robust because its magnitude varied little when considered simultaneously with other pollutants. Although PM_{10}, SO_2, and NO_2 were also associated with hospital admissions, none could be singled out as more important than the others. It is apparent that different analyses of the same, or closely related data sets (Moolgavkar et al. extended the

time frame of the two Schwartz studies by adding two more years of data) by different models (i.e., Davis et al. and Moolgavkar) yield different results (see Table 1).

The conclusions of these many reanalyses, exemplified most recently by the comparison of the results in Birmingham and Minneapolis-St. Paul, and earlier in the work of the Moolgavkar and his colleagues, as well as the HEI-sponsored studies, are two-fold. The first observation is that apparent consistency may be an artifact of model selection and analytical technique. In many cases, the attribution of significance to one pollutant may be attenuated or eliminated by reexamination of the data with alternative models whose fit is equally good as that of the original investigators (e.g., the inclusion of relative humidity in the model by Davis et al.). This observation alone requires the careful consideration of alternative hypotheses.

Secondly, even when there is no attenuation of overall association between air pollution and adverse health outcome, a different pollutant often appears to be responsible for the increase in relative risk. In some cases, measures of particulate, such as TSP or PM_{10} appear to have the most affect on mortality; in others, ozone or SO_2 appears to play a more significant role. Given the degree to which model selection and model inputs influence outcomes, it is premature to attribute causality to $PM_{2.5}$, or perhaps to any component of air pollution.

When viewed as a group, the reanalyses outlined here present a logical, methodical analysis of each of the data sets. In the case of the Philadelphia and Steubenville data sets, Moolgavkar et al. demonstrated that although there appeared to be a relationship between TSP and mortality, estimates of its magnitude were strongly affected by the consideration of copollutants such as ozone and sulfur dioxide. The studies of Davis et al. demonstrate that the consideration of relative humidity can attenuate the PM effect to non-significance.

Considered together, the reanalyses of Moolgavkar et al., the HEI group, and Davis et al. illustrate the many uncertainties that exist in the use of weak epidemiological responses in establishing cause-effect relationships. Alternative analytical methods support a link between mortality and air pollution in general, or perhaps particulates, but also imply that the relationship between PM and mortality may not be as robust as initially reported. Thus, although these reanalyses do not always refute positive associations, they strongly suggest that the relationship between particulates and mortality is complex and highly dependent on which analytical methods are employed, the presence and consideration of copollutants, and measures of weather and seasonality. In the context of setting new NAAQS, however, perhaps the most important point to note is that none of the carefully performed studies were able to make a causal association between $PM_{2.5}$ and increased mortality or morbidity.

Table 1
Examples of PM-Associated Response Attenuation when Copollutants are Considered

		Exposures Considered						
Study	**Endpoint**	**PM**	**PM/W**	**PM/O_3**	**PM/ SO_2**	**PM/ O_3/SO_2**	**PM/O_3/ SO_2 /W**	**PM/O_3/ SO_2/N O_2**
Steubenville								
Dockery and Schwartz 1992	mortality	+	+	nc	a[1]	nc	nc	na
Moolgavkar et al. 1995	mortality	+	- a	nc	- a	nc	a	na
Philadelphia								
Dockery and Schwartz 1992	mortality	+	+	nc	a[1]	nc	nc	na
Moolgavkar 1995	mortality	+	+ S	- a in S	- a, except S	- a	+ O_3 S + SO_2 sp + SO_2 w	
Birmingham								
Schwartz 1993	mortality	+	+S - sp, f,w	nc	nc	nc	nc	na
Schwartz 1994	pneumonia/ COPD	+	+	nc	nc	nc	nc	na
Davis et al. 1996	pneumonia/ COPD	+	-	na	na	na	na	na
Moolgavkar et al. 1996	pneumonia/ COPD	-	-	+	-	-	-	na
Minneapolis/St. Paul								
Schwartz 1994	pneumonia/ COPD	+	+	-	a[1]	nc	nc	na
Moolgavkar et al. 1997	pneumonia/ COPD	+	+	+a	a	O_3 robust others: a	a	+ O_3 =

Table 1
Examples of PM-Associated Response Attenuation when Copollutants are Considered

		Exposures Considered						
Study	**Endpoint**	**PM**	**PM/W**	**PM/O_3**	**PM/ SO_2**	**PM/ O_3/SO_2**	**PM/O_3/ SO_2 /W**	**PM/O_3/ SO_2/N O_2**

PM = TSP for Steubenville, Philadelphia
PM = PM_{10} Birmingham, Minneapolis-St. Paul
PM/W = PM and weather considered simultaneously
COPD = chronic obstructive pulmonary disease

+ = Statistically signficant association noted by authors
- = no statistical signficance
a = attenuation of effect noted compared with PM considered with any individual or multiple co-exposure.
nc = not considered
na = not applicable

[1] TSP association independent of SO_2, but not vice versa
S = summer, sp = spring, f = fall, w = winter
= PM_{10}, SO_2, NO_2 effects approximately equivalent

B. Measurement Uncertainty and the Ecological Fallacy

Even if the differences in the components of air masses among the studied regions and populations were well characterized, there is still the question of the degree to which population measures can be applied to individuals. As previously mentioned, almost all of the epidemiologic evidence linking exposure to particulates with morbidity or mortality are ecological, in which population, but not individual, exposures are characterized[3].

Epidemiologists have traditionally assumed that ecological studies should be used to generate hypotheses, and not test them. In fact, there is a body of literature on the "ecological fallacy" (e.g., Schwartz 1994; Brenner et al. 1992; Greenland et al. 1989; Piantadosi et al. 1988; Richardson et al. 1987), which is defined as the observation that associations observed at the aggregate level (i.e., populations) may not apply either to individuals within the group, or to individuals across groups. In their seminal paper on the ecological fallacy, Piantadosi and colleagues (1988) caution that "*the consequences of confounding bias in the ecological analysis*

[3] Measures of air pollutants are gathered from stationary samplers set up in central areas (or up- or down-wind of emitters). In general, the time series studies obtained measurements from multiple samplers in each city; the prospective studies employed one sampler per city. These units collect samples of air onto various substrates that are then typically analyzed for mass, particle number and size distribution, and elemental composition. The composition of the air mass is inferred from these analyses.

are more severe [than for individual level analyses]. With respect to inferences about individuals, the proposed role of ecological analyses is to generate new hypotheses which must then be tested using more appropriate experimental or observational methods." They further caution that inferences regarding the applicability of exposure/outcome relationships should be confined to the observable range for putative linear and non-linear exposure-response relationships. Gamble and Lewis (1996) have also reiterated the need to comment on the utility of confirming hypotheses raised by ecological studies with additional "hypothesis-generating" studies.

By using measures of population exposures, ecological studies introduce a form of bias, or potential systematic deviation from the "true" exposure:response relationship. For example, if measures of population exposure consistently overestimated individual exposures to the true causal agent, extrapolated risk estimates would understate true risk to the individual (i.e., the "potency" of the causal agent would appear to be lower); conversely, if population exposures were underestimated, extrapolated estimates of individual risk would be overstated (i.e., the "apparent potencies" would be high).

The question then arises if the ecological nature of the studies introduces a predictable bias in the prediction of risk to the individual in either direction (i.e., to systematically increase or decrease apparent risk), and if it would be possible, after the fact, to reconstruct the individual's exposure or at least determine whether exposure had been over- or under-stated. Piantadosi et al. (1988) concluded that no consistent prediction could be made for the direction of the bias introduced by ecological studies.

Brenner et al. (1992) have examined a specific case of potential bias by evaluating the effects of nondifferential exposure misclassification in ecologic studies to determine the direction of the introduced bias. (Non-differential misclassification is defined as the equal probability of misassigning individual exposure in all study groups). They concluded that although the effect of non-differential misclassification tends to bias towards the null in studies of individuals (i.e., decrease apparent risk), the opposite effect is likely when ecologically derived rate ratios are applied to individuals. In other words, if individuals in an ecological study are misclassified as "exposed", (e.g., experiencing the same exposures as measured in a community sampling device) when, in fact, they are not, the effect of the bias would be to overestimate the exposure:response relationship or make the exposures appear to be more "risky" than it actually is. Others (as reviewed by Gamble and Lewis 1996) agree with Piantadosi that it is not possible to predict the direction of the potential bias.

Thus, it is not possible to predict whether ecologic studies quantitatively over- or under-predict individual exposures. For any given study, the error may occur in either direction; for the

body of evidence, both under- and over-prediction may have occurred. The interpretation of the effect of measurement uncertainty in the face of the small increases in relative risk observed in the epidemiologic studies is difficult. It may be that if appropriate corrections were made to compensate for the differences in individual vs. group exposures the apparent risk ratios could increase; alternatively, attenuation of effects may also result.

The implication of this general observation for estimates of PM-associated risk is that given the uncertainties in estimating individual exposures, even if measures of air pollutants at *central monitors* were well-characterized with respect to particulates (including $PM_{2.5}$), it is still not possible to predict the exposures of *individuals* potentially at risk for adverse health outcomes. Without such exposure measures, it is not possible to state whether an individual dying or experiencing respiratory difficulty during the lag-period following a high-pollutant episode was indeed exposed to either a) outside air, or b) an elevated level of any specific pollutant (i.e., ozone, $PM_{2.5}$ or PM_{10}). Further, it is also not possible to determine whether the individual exposures are likely to be over-or under-predicted; thus, we can not begin to determine whether we have under- or -over predicted risk. Therefore, given the inability to characterize exposures on an individual basis, the attribution of a causal relationship between exposure to any specific pollutant and the individual's life or health status is, at best, overstating the confidence that can legitimately be placed on the data.

1. Exposures

Review of the empirical data correlating community sampler measurements with individual exposures indicates that the former rarely provides a good estimate of individual exposures. The early study of Spengler et al. (1981) demonstrated that there was almost no correlation between outdoor PM_{10} concentrations (as measured by ambient samplers) and personal exposures in the cities included in Dockery et al.'s Six City Study data. For example, in each of the cities except Steubenville, indoor exposures significantly exceeded outside exposures to respirable particulate (i.e., PM_{10}). Moreover, the presence of a smoker in the house provided the dominant source of indoor air pollution. Homes with one smoker had mean increases in indoor particulate by 12 $\mu g/m^3$; two or more smokers increased the mean by 46 $\mu g/m^3$. Other contributors to the level of indoor particulate were seasonality, activity levels, air conditioning, and ventilation.

The authors concluded that their data demonstrated the inherent difficulties of extrapolating an individual's exposure to respirable particulate matter from ambient monitoring of the geographic area. The latter reflects differences in emission sources and strengths, meteorologic conditions, and background air mass, while the former is more

closely associated with personal activities (which may generate more particulate, especially $PM_{2.5}$), indoor sources such as stoves (which may generate more NO_x), and the ventilation characteristics of individual homes (tightly sealed houses tend to concentrate indoor-generated compounds and inhibit the infiltration of outdoor pollutants). Interestingly, sulfate levels indoors were lower than at sites immediately outside homes or at central monitoring stations (which correlated well), presumably because of the low potential to generate sulfates within the home. Thus, outdoor ambient monitors poorly represent the qualitative and quantitative nature of individuals' exposures.

More recently, a joint study between USEPA's Atmospheric Research and Exposure Assessment Laboratory (AREAL), the State of California's Air Resources Board (CARB), the Research Triangle Institute, and Harvard University (Özkaynak et al. 1996) evaluated personal exposures to particles and metals in Riverside, California. Estimates of exposures from ambient monitors were compared with outdoor concentrations near homes (backyard samples), and then compared with measurements made from stationary indoor and individual samplers worn by the 178 participants in the study (personal samples). Participants were non-smokers and ranged in age from 10 to 70. The results of this study indicated that central and backyard measurements were reasonably well correlated, implying that for this population at least, quantitative estimates of particulate mass (expressed as PM_{10}) were reasonably well-correlated with stationary indoor monitors. Particle samplers worn by individuals over the course of the day, however, indicated that an excess mass of particles or "personal clouds" were experienced by the participants. Population-weighted daytime personal PM_{10} exposures were 150 ± 9 $\mu g/m^3$ (mean and standard error), compared with concurrent indoor and outdoor concentrations of 95 ± 6 $\mu g/m^3$.

Based on elemental analyses, the authors determined that more than half of the indoor particles were generated outdoors, but the remaining particles were of unknown origin, although it appeared that the aerosol collected by personal monitors was of the same general chemical composition as the indoor aerosols. The elemental analysis also suggested that particulates in the personal cloud consisted largely of the coarse fraction and a portion of the fine fraction, but probably did not include particulates below 1 μm. Thus, it is likely that for this group of individuals, personal clouds of particles were generated as part of indoor day-time activities; levels were lower at night when individuals slept or presumably participated in lower particle-generating activities.

The authors concluded that although outdoor concentrations of particulate near homes were well correlated with central site measurements, indoor concentrations were

only weakly correlated with outdoor concentrations, and "*personal exposures were even more poorly correlated with outdoor concentrations*". As people spend much of their time indoors, centrally located outdoor monitors have limited utility as predictors of quantitative or qualitative individual exposures, and the ecological fallacy holds (i.e., overall population measures of exposure are not closely associated with individual measures). This observation has been repeated consistently since Spengler's work in 1981.

In preliminary reports, Koutrakis et al. (1997) have also observed that in temperate climates (e.g., Boston and Nashville) the relationships between personal exposure to PM and outdoor measures, differentiated as either PM_{10} or $PM_{2.5}$, are poorly correlated. Less correlation (on a mass basis) is observed in winter, when houses tend to be closed, than summer ($r = 0.39$ and 0.69, respectively for $PM_{2.5}$; for PM_{10}, no significant correlation was observed in winter, $r=0.46$ in summer). It is notable that these studies were conducted with volunteers suffering from chronic obstructive pulmonary diseases (COPD), populations likely at highest risk (see Biological Plausibility) of morbidity (exacerbation of symptoms) or mortality. We look forward to the completion of these studies, their submission for peer-review, and incorporation into USEPA's overall assessment of risk.

Another important but unanswered question is the degree to which measures of outdoor air pollution correlate with personal exposures in hospitals, in which the relationship between outdoor and indoor air is less-well correlated due to filtered HVAC systems. The implications of the lack of representativeness of outdoor exposure for increased mortality are significant, especially when considered in the context of mortality displacement in compromised individuals, given the qualitatively different nature of potential exposures inside hospitals and at outdoor central monitoring stations (see also discussions of Biological Plausibility and Coherence).

In a preliminary report, Lillquist et al. (1996) have shown that the correlation between central monitors of PM in the Salt Lake Valley and three hospitals in the Valley was a function of degree of pollution. At low pollution levels, recorded PM_{10} levels at hospital roof-tops were approximately equal, but the hospital monitors indicated less particulate matter than the central monitors as the pollution rose. More important, however, to the issue of individual exposures and outcomes, was the degree to which inside monitors at the hospitals varied in their descriptions of PM levels at individual sites, and the lack of prediction of those measurements by outdoor monitors. Clearly, for deaths among hospitalized individuals (see discussion of Sensitive Sub-populations in the Biological Plausibility section), central monitors do not adequately describe patient's exposure experiences.

Thus, the differences between individual and ambient measures of exposure may bias epidemiologic studies, although as previously stated, the direction of the bias cannot be determined without individual measurements. Individuals living in geographic areas that are low in particulate pollution, by virtue of living in houses with different construction and ventilation patterns, the presence of smokers, or other lifestyle differences, may have relatively high exposures to particulates. Conversely, individuals living in areas with apparently high levels of pollution, may for similar reasons (i.e., well-sealed homes with air conditioning) experience lower pollution levels. In order to diminish the effects of potential misclassification, a better understanding of the extent of individual exposures needs to be developed, particularly for those individuals classified as "susceptible" (i.e., individuals with pre-existing respiratory or cardiac ailments).

The implications of potential misclassification are critical not only for determining causality, but even if causality were assumed, for the evaluation of dose-response (see accompanying submission on the Qualitative Risk Assessment (ENVIRON 1997). Given the potential for individuals to experience a "personal cloud" of particulate matter, it is likely that outdoor monitors obscure the true relationship between such exposures and individual health outcomes, especially for COPD patients (the ongoing Koutrakis research is critical for characterizing such exposures). Moreover, if all individuals are exposed to a "personal cloud" of particulate matter on a daily basis that is unrelated to outside measures of PM (or other pollutants), the imposition of a linear-relationship between exposure (as measured from central monitors) and outcome in the quantitative risk assessment is likely incorrect and misleading.

2. Other Risk Factors

Lipfert and Wyzga (1995a) point out the disadvantage of extrapolating from population to individuals for measures of otehr risk factors as well as exposures. The increase in morbidity or mortality in population-based studies (e.g., those that compare groups across residential communities) may be due to some characteristic of the community that is not related to air pollution. It could be, for example, a function of the socio-economic status of one city relative to another, with lower status correlating with less access to medical care or less attention to life-style choices such as individual smoking, exercise, or dietary habits. The inhabitants of Watertown, Massachusetts, a suburb of the coastal Boston, could easily differ in lifestyle and dietary intake from those of Portage Wisconsin, a more agricultural community in a high dairy consuming area.

The cross-sectional cohort studies, by virtue of having more information on individuals' personal characteristics and risk factors, may be less subject to the influence of ecological assumptions persisting to individuals, although they remain ecologic studies by virtue of having no individual measures of pollutant exposures. In the Six City study, Dockery et al. (1993) accounted for age, sex, active smoking, body mass and education, and found them all significant contributors to the association between exposures to $PM_{2.5}$ and SO_2 and mortality. Pope et al. (1995) in their prospective study of ACS respondents corrected for age, sex, race, active and passive smoking, education, body mass, alcohol consumption, and some occupational exposures, and found significant influences on associations between SO_2 and $PM_{2.5}$ for age, sex, race, and active smoking. Lipfert and Wyzga (1995b) reanalyzed some of these data to demonstrate that the "ecological regressions" were highly dependent on the covariates included in the regression. As variables related to socioeconomic status were entered into their regression analyses, the relative contribution of pollutant exposures decreased to non-significance. Lipfert and Wyzga suggest that had the original investigators included these variables in their analyses, similar conclusions might have been reached (i.e., failure to systematically consider individual risk factors allowed for the persistence of apparent associations between exposures to air pollutants and increased mortality.)

Thus, careful evaluation of the body of evidence does not allow for the assignment of causality to the particulate component of air pollution. In fact, application of the appropriate variables to the data have been shown to attenuate the apparent association between PM and adverse health outcome to levels of non-significance.

Given the effect of such reanalyses, the coherence and consistency aspects of the data base used by USEPA as justification of causality are much less compelling. We urge the incorporation of these, and similar reanalyses into USEPA's hazard characterization and to extend such techniques to other key studies so that the appropriate etiologic agent(s) can be identified.

IV. APPLICATION OF CAUSAL CRITERIA IN LIGHT OF ALTERNATIVE APPROACHES

In this portion of our comments, we consider the key aspects of empirical association for determining whether an association is causal, i.e., the widely-referenced Hill criteria for causality (Hill 1958)[4]. It is important to note that Bradford Hill did not require that all of these aspects or criteria be met prior to inferring causality, but rather, developed them as guidelines when "*an association [is observed] between two variables, perfectly clear-cut and beyond what we would care to attribute to the play of chance. What aspects of that association should we especially consider before deciding that the most likely interpretation of it is causation?*"

Of these aspects or criteria, one is clearly necessary, although not sufficient: temporality. In Bradford-Hill's words "*which is the cart and which the horse*?" USEPA implicitly accepts the temporality criterion, and then relies on the apparent coherence (i.e., similar qualitative ranges of responses) and consistency (i.e., the same magnitude of association) of the evidence across the body of evidence as being *"consistent with expectations based on assuming causal relationships between mortality and morbidity effects and PM exposure*".

In this discussion, we approach the apparent association between exposure to PM and adverse health outcomes with Wynder's (1987) previously stated caution in mind: when the strength of the association is weak, additional reliance must be placed in arguments of biological plausibility in order to have confidence in assigning causality to a particular component, or subset of components, of the complex mixture of air pollutants. Given that caution, we have approached the Hill Criteria from the perspective of building a credible biological argument for attributing causality to PM by considering increasing levels of complexity of response (i.e., biological plausibility, coherence, and consistency). Dose (or exposure)-response issues are more fully addressed in our companion set of comments on the Quantitative Risk Assessment (ENVIRON 1997).

A. Biological Plausibility: Is the association one that is grounded in some credible biological mode of action?

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[4] These include strength, consistency, specificity, temporality, biological gradient (dose-response), plausibility, coherence, analogy. It is important to note that Bradford-Hill cautions against the rote application of these aspects to determine causality.

As previously mentioned, when the strength of association is weak, increased weight is placed on elucidation of the biological mechanisms that support the observed statistical associations. Although the issue of biological plausibility or potential mode of action for individual or combined air pollutants at current ambient levels has been the subject of significant research, to date, there is no compelling evidence to indicate that low level exposures to $PM_{2.5}$ or PM_{10} can cause such effects.

1. High to Low Dose Extrapolation

For high-level exposures to particulate matter, it is not difficult to hypothesize a mode of action that involves physical occlusion of respiratory surfaces, or one that induces or exacerbates cell death at the target site (e.g., low pH). The epidemiological evidence from the Meuse Valley, Donora, Pennsylvania and the London fog episode of 1955 (as reviewed by USEPA 1996) and the toxicological evidence from laboratory animal studies (reviewed by USEPA 1996 and Amdur 1996) leave little doubt that very high exposures to air pollution or some of its components (e.g., sulfates, sulfuric acid, and high levels of different size distributions of particulates) can and do cause death or respiratory distress in individuals with pre-existing cardiac or pulmonary disease, especially among the elderly. Utell and Framptom (1995) have pointed out, however, that there are no data to suggest that ambient air pollution is a direct cause of death in healthy people, "even in the most severe historical episodes".

Even at the high air pollution concentrations known to cause death, the nature of the injury responsible for increased mortality is unknown. In the Meuse Valley incident in Belgium during December of 1930, the concentration of air pollutants became so high that 60 people (and many cattle) died during and immediately after the temperature inversion responsible for those conditions. Wilson (1997) cites Firket (1931) estimating the SO_2 concentrations as being in the range of 25-100 **mg**/m^3. It is interesting to note, however, that the autopsies of affected individuals indicated only "general irritation and congestion of the mucosa of the tracheas and large bronchi in the upper respiratory tract" (Wilson 1997). Thus, the nature of the injury and the etiologic agent are not immediately apparent.

The responses noted at lower levels of exposure (e.g., increased mortality, exacerbation of existing respiratory disease), are not easily or intuitively extrapolated from high-dose animal exposures. In fact, Amdur (1996) has stated that studies in experimental animals provide a portion of the data base that should be employed in evaluating the human health effects of air pollutants if criteria that are sensitive and biologically relevant

to human responses are used. In this context, she states ***"Extrapolation from results obtained on high concentrations is not appropriate"*** (Amdur's emphasis).

2. Nature of the Etiologic Agent

Two questions must be addressed in order to develop a defensible argument for biological plausibility: (1) What is the nature of the likely etiologic agent? and (2) Can a credible argument be made for biological responses (i.e., mortality and morbidity) at the exposure levels likely encountered in ambient air masses?

For the first, it is necessary to identify the physical and chemical properties of the potential etiologic agent impinging on the target tissue or organ. For air pollutants encountered in contemporary air pollution, the range includes two overall classes of pollutants:

(1) Particles measured or described as total suspended particulate (TSP), coefficient of haze (COH), PM_{10}, $PM_{2.5}$, and "coarse particles" (i.e., the difference between PM_{10} and $PM_{2.5}$); and

(2) Individual precursors and persisting components including H_2SO_4, H^+, SO_2, NO_2, CO, and O_3, and possibly, metals or organic compounds.

It is important to note that particles are not "inert" substances composed of single chemical moieties. SO_2, for example, can comprise a significant portion of the ultrafine fraction of particles (Amdur 1996); acidic or metallic residues may be adsorbed onto particulate matter (Costa 1997, Dreher et al. 1996). Because the surface area of fine particulates is very large relative to the particles' mass, there is substantial opportunity for different substances, (e.g., acids, organics, and metals) to adhere to the particles. Thus, what is "seen" by the target tissue(s) may not be the core of the particle, but rather its coating.

The potential role(s) of the non-core particulate components should also be considered in the search for a causal agent. For example, are there arguments for the role of sulfate, either as H_2SO_4 or SO_2, ozone, CO, NOx, or metals in the induction or exacerbation of adverse health outcomes? Do any of these compounds induce similar effects either in humans or laboratory animals at exposure levels similar to those encountered by humans exposed to contemporary air pollution? The answers to these

questions are an unequivocal "yes" and are discussed in Section 5, *Empirical Evidence Contributing to a Mechanistic Hypothesis*.

Particle size is, nonetheless, a critical factor in determining the region of the respiratory tract in which a particle will be deposited, and may be partly responsible for the potential to induce toxic effects. Most coarse particles, i.e., those with an aerodynamic diameter of 10 μm or larger, are deposited and trapped in the nose or oral pharynx. Because these particles generally do not enter the lung, they are not considered to be of significant concern to human respiratory health. Although some particles smaller than 10 μm are captured in the trachea, and removed by coughing or swallowing, they can penetrate lower into the bronchial and, finally, into the deepest alveolar regions of the lung. Generally, particles smaller than 5 μm and larger than 0.003 μm can be deposited in the alveolar region with some efficiency, and particles of 1 to 2 μm are the optimal size for reaching the alveoli. Ultrafine particles ($PM_{0.1}$ and smaller) have fairly short half-lives near their sources and convert into larger particles as the result of accumulation onto or with other particles.

Other mechanisms exist for the removal of particles that penetrate beyond the upper airways. Alveolar clearance from the deepest regions of the lungs can occur by several mechanisms: transport on the mucociliary ladder of the upper airways; ingestion by alveolar macrophages and exit via lymphatic drainage or the mucociliary ladder; or dissolution and removal via the bloodstream or lymphatics, where systemic availability may occur. Small particles may directly migrate into the lung wall (epithelium, interstitium or pleura), where some are retained (occlusion), and others pass on into the circulatory system.

Thus, although on the basis of penetration to oxygen-exchanging regions of the lung, the argument can be made that small particles (i.e., $PM_{2.5}$) may be toxicologically more important than larger ones, there is no readily apparent hypothesis to explain how relatively low levels of such particles can cause death or the exacerbation of disease. To do so may require additional information about the types of individuals who may be subject to such effects.

3. Identification of Sensitive Subpopulations Based on Putative Mechanisms

Because particle deposition and clearance can be affected by various factors including breathing patterns and health status, the identification of potentially susceptible (i.e., at risk) individuals may be important when considering issues of biological plausibility. Based on the epidemiologic and experimental data, it appears that "normal"

people, that is, individuals who do not exhibit compromised respiratory function, are not at risk from current-day ambient air pollution, or even the severe episodes noted earlier. This is consistent with what is known about particle deposition and clearance from normally functioning respiratory systems. However, changes in the diameter of conducting airways also alter particle deposition. For example, partial airway occlusion such as that seen in patients with chronic bronchitis or obstructive airway diseases can increase deposition of particles in small airways. Infection and physical injuries also can greatly impair mucociliary clearance. Thus, individuals with compromised respiratory function, (e.g., chronic obstructive pulmonary disease (COPD) such as emphysema and chronic bronchitis, asthma) and possibly the elderly or infants may be more physiologically susceptible to such exposure conditions by virtue of retaining higher doses of pollutants. As noted earlier, however, even these individuals showed no gross abnormalities or lesions in their respiratory tracts.

Because the number of functioning bronchioles and alveolar regions in the potentially susceptible individuals is decreased, the argument has been proposed that those regions of the lung with full or partial functionality may experience even higher exposures. However, increases in ambient particle concentrations of approximately 20-40 $\mu g/m^3$ are associated with increased risk in the epidemiologic studies; these amounts would result in relatively small increases in peripheral lung particle deposition. From the perspective of overall lung function, it seems unlikely that such particle concentrations could worsen ventilation-perfusion ratios in either healthy or respiratory-impaired individuals to the point of producing hypoxemia and the consequent pulmonary edema, increased permeability, or malignant arrhythmia that are proximate causes of death in cardio-respiratory failure (Utell and Samet 1997).

Controlled human exposure studies have generally shown no association between exposures to PM and copollutants and measures of pulmonary function or exacerbation of symptoms (reviewed in EPA 1996a) in healthy or asthmatic individuals. Experimental studies of PM in humans have been limited to exposures to H_2SO_4 aerosols; the ten studies published since 1988 have shown that healthy individuals show no changes in lung function following acute exposures at levels up to 2,000 $\mu g/m^3$ for one hour. Studies of asthmatics did not show a consistent pattern of response. Some asthmatics, particularly adolescents, show an increased sensitivity to small decrements in lung function following exposures to H_2SO_4 in the range of the NAAQS; others do not. Responses in asthmatics, however, tended to be related to the irritant potency of the inhaled particulate (i.e., the acidity of the particle *per se*) as opposed to its chemical constitution (i.e., sulfate), and can

be counteracted by neutralization of the acidity by inhalation of ammonia. Older volunteers with COPD (mean age= 62) exposed to 90 $\mu g/m^3$ H_2SO_4 demonstrated virtually no change in lung function, even after mild exercise during the exposure periods (Morrow and Utell 1995). Thus, in their review of clinical and pathogenic considerations of exposures to particles, Utell and Samet (1996) have concluded that "*decrements in lung function are relatively small after exposure to acid particles, are non-progressive, and mitigated by ammonia neutralization. Individuals with COPD do not appear to respond to particle inhalation with bronchoconstriction or respiratory symptoms*".

Given the difference between the exposures experienced in the volunteer and epidemiology studies (i.e., very complex mixtures vs. defined exposures, healthy or relatively healthy young subjects vs. elderly, possibly very ill, populations), it is difficult to make direct comparisons or extrapolations between the clinical findings and potential effects of environmental exposures. Nonetheless, the observation that no significant adverse effects from exposure to acid aerosols at concentrations several times higher than the NAAQS suggests either that different mechanisms are involved, or that the effects noted in the epidemiologic studies are among susceptible subpopulations that were not included in the controlled human trials. Attribution of causality to either particulate or chemical constituents of PM is thus difficult to postulate.

4. Temporal Relationships in Pathophysiological Responses: Premature Mortality as a Paradigm

No pathophysiologic mechanisms linking exposure to current low levels of air pollution and increased mortality have been able to explain the increase in either mortality or morbidity in a manner sufficient to accommodate the temporal relationships between exposure and outcome. Although it is possible to construct a hypothesis in which exposure to air pollution could contribute to the incidence of asthma, chronic bronchitis, or other obstructive airway disease, years of exposure would need to be experienced for the deterioration of the respiratory system to progress to frank disease, even in susceptible individuals. This is inconsistent with the onset of daily mortality observed in the epidemiologic studies. Further, smokers expose themselves daily to particulates several times in excess of ambient air pollution; years are required before significant changes to pulmonary function result, and as Utell and Frampton point out (1995) only a minority of smokers appear to be to susceptible to either emphysema or cancer. Of course, there may be a self-selection process occurring when individuals begin to smoke: those unable to tolerate the inhalant most likely do not acquire the smoking habit. Nonetheless, there

appears to be a host-susceptibility component to the increase in morbidity, and possibly mortality. Given the potential inherent sensitivity of some individuals to such insults, elucidating the nature of the precipitating event for these effects becomes more important as an individual control strategy for these individuals, and perhaps a more effective public health strategy than imposition of a $PM_{2.5}$ standard.

One prevailing hypothesis regarding mortality, based on observations of increased mortality among aged (> 65 years) populations is that the acute effect(s) of PM manifest themselves by exacerbating pre-existing disease in individuals with compromised health, most likely due to respiratory or cardiovascular disease (Spix et al. 1993; HEI 1995; Seaton et al. 1995; EPA 1996a). Spix et al. (1993) hypothesized that elevations in mortality were due to a phenomenon referred to as "harvesting" in which individuals who likely would have died in the immediate future in the absence of air pollutants, exhibited advanced rates of death due to some component, or mixture of components, of the air pollutants. In their study of SO_2 and TSP, a 10 percent (± 2%) increase in deaths was noted for an SO_2 increase from 23 to 928 $\mu g/m^3$, and a 22 percent (CI = 14-27%) increase in mortality for an increase in particulate levels from 15 to 331 $\mu g/m^3$ in the preceding two days. The authors cautioned that their interpretation of the data should be restricted to short-term effects (i.e., imminent deaths occurring a few days earlier under unfavorable conditions than they would have otherwise), and not extrapolated to longer time frames.

Although the "harvesting" hypothesis is plausible, it remains subject to caveat. Premature mortality has been observed in epidemiologic studies of other exposures, most notably, temperature deviations. Kunst et al. (1993) have shown in time series analyses that there are relationships between temperature changes and increasing mortality when deviations from an "optimal range" occur in either direction (i.e., hotter or colder). They observed that in the Netherlands, excess mortality due to moderate temperature changes was observed among the chronically and terminally ill, and hypothesized a "last-straw" insult to overburdened physiological compensatory systems.

The "harvesting" effect requires that if deaths had been hastened by a few days, a decrease in death rates should be observed in the few days following the change in temperature. Such decreases were observed in the temperature-related mortality studies (Kunst et al. 1993), but the evidence for subsequent decreases in death rates following air pollution episodes have not been observed. It may be, however, that the recent epidemiologic studies linking PM and mortality have insufficient statistical power to detect such changes. Nonetheless, in the studies of mortality following the London fog event of 1952, in which PM exposures were an order of magnitude higher than current air pollution

levels (i.e., approximately 1,500 $\mu g/m^3$ (measured as British Smoke) vs 150 $\mu g/m^3$ current 24 hour standard for PM_{10}), death rates for the last half of December and early January of 1953 should have decreased, mortality rates remained elevated for several weeks (cited by Utell and Frampton (1995) and Wilson (1996)).

Thus, although there are aspects of the premature mortality hypothesis that are consistent with the reported increases in mortality associated with current air pollution levels, the lack of observed decrease in death rate following the "harvesting effect", and the inability to restrict effects to PM or some component of PM leave this hypothesis unconfirmed as an explanation for acute mortality.

5. Empirical Evidence Contributing to Mechanistic Hypotheses

The question of the pathophysiology of response and nature of etiologic agent remains perplexing. A plausible mechanism should be able to account for inflammatory responses at the deep lung that, perhaps in combination with individual host-characteristics (e.g., compromised respiratory or cardiac function) that "increase the likelihood of death slightly but enough to be visible in a large population" (Utell and Samet 1996). Based on the previous review of the issues involved in biological plausibility, including studies of healthy and respiratory-compromised individuals, how then is it possible to implicate $PM_{2.5}$ as the sole causal agent without a careful review of alternative hypotheses?

Oberdörster et al. hypothesize (1994, 1997) that the most likely etiologic component of PM is the ultrafine mass distribution ($PM_{0.5}$ or less), and that the most appropriate dose metric for those particles is their surface area, (the specific surface area for ultrafine titanium dioxide particles (mean diameter 20 nm) was determined to be 50 m^2/g, vs. 6.4 m^2/g for the fine particles, mean diameter 250 nm). Further, they have speculated that the increased retention and subsequent changes in cellular morphology observed following exposure to ultrafine particles is a function of the interstitial persistence of those particles, followed by releases of cytokines and other growth factors by activated macrophages. This hypothesis, although attractive, must be considered in light of the very high particle burden that was imposed on the animals as well as the qualitative difference in the particles from those likely to be encountered by humans exposed to ambient air.

A similar hypothesis, based on human observations, has been put forth by Seaton et al. (1995). They develop the argument, based on theoretical grounds, that very small but chemically reactive (acidic) airborne particles produce inflammation at the alveoli which then induces acute changes in blood coagulability. Subsequent release of other

cytokines and mediators might then produce acute respiratory or cardiovascular disease in susceptible individuals. Seaton et al. hypothesize that the inflammatory changes induce a series of cellularly derived cytokines that can in turn induce a potentially life-threatening condition in persons with existing respiratory or cardiovascular disease. No indication of the nature or amount of particulate responsible for inducing these effects was provided.

Various animal models of human cardiovascular or pulmonary disease are consistent with the observation that increased sensitivity to air pollution components exists. Amdur (1996) has reviewed several recent reports of such observations; in summary, these studies indicate that animals with pre-existing pulmonary inflammation or airway resistance show increased susceptibility to acidic or metal-coated particles, and that toxicity can be largely attributed to the coating of the particles. In addition, studies of animal models with induced pulmonary hypertension (Costa et al. 1995) also showed increased susceptibility to ambient aerosols that produce inflammatory responses, i.e., those enriched in acids or some metals. Particles coated with transition metals (e.g., iron) may catalyze activated oxygen species which have been known to induce the migration of phagocytes and inflammation (Tepper et al. 1994).

These hypotheses and experiments provide clues for the eagerly sought-after toxicological explanation that would contribute to evaluating biological plausibility and coherence. Those invoking an inflammatory cascade may indeed provide a useful tool to dissect the physiological responses of compromised individuals to different inhaled insults, but as hypotheses, they do not prove the role of PM in humans exposed to current ambient air pollution, and are inconsistent with the observations in the limited volunteer studies.

The studies evaluating metal toxicity are also important in that they have identified a group of chemicals (e.g., transition metals) that can cause the inflammatory responses hypothesized by Seaton et al. (1995). However, the animal studies have been performed using methods of administration (i.e., intratracheal instillation) and dose levels that far exceed those experienced by humans at current air pollution levels. Given Amdur's warning against high to low dose extrapolations, although these experiments provide important clues that contribute to understanding toxicological mechanisms at work in the deep lung, at the exposures that have been tested, they have limited utility for providing direct evidence of increased morbidity or mortality in humans at ambient air pollution levels.

6. Alternative Hypotheses: Pollutant Potency

When citing these and other studies as qualitatively consistent with results observed in human studies, and particularly when addressing issues of quantitative risk assessment, the assumption is often made that "particulates", regardless of their source, chemical composition, or physical properties, have approximately the same "potency" for inducing either mortality or morbidity. In other words, when data are collected from sampling stations, all of the condensed matter that is found on sampling filters is presumed to have the same toxicity per unit mass.

Lippman and Thurston (1996) have presented an interesting alternative hypothesis, that identification and characterization of the matter collected on sampling devices may introduce artifacts of the collection and processing systems, and that these artifacts may contribute to the over-or under-estimation of toxicity, and perhaps, misattribution of causality. They believe that a working hypothesis is one that incorporates aerosol acidity in the etiology of PM-associated health effects in humans. Although not universally accepted, this argument is based on the observation that controlled exposure studies indicate that sulfate aerosols containing strong acids (e.g., H_2SO_4) produce "*structural and functional changes in healthy subjects consistent with those observed in epidemiological studies, and do so at exposures within the upper bounds of current H^+ ambient levels*" and previous studies (Lippman 1989) indicating that H^+ "*is the most likely causal factor for the observed associations between PM and chronic mortality.*"

In their report they note that sulfate ion concentrations have generally correlated better with indices of both mortality and morbidity in populations than other indices of PM (i.e., TSP, BS, COH, and PM_{10}) (see table), and may thus serve as a useful surrogate of exposure for other copollutants. They further hypothesize that because fine particles are enriched in carbon, H_2SO_4, H^+, organics, and trace metals, it may be likely that some adsorbed chemical moiety may be responsible, or co-responsible for PM-associated mortality and morbidity. This hypothesis is consistent with the limited observations of altered respiratory function in volunteer asthmatics, although again, not confirmed by the small studies of COPD volunteers, or the lack of response at lower, inhaled concentrations of particles in the laboratory animals studies.

Table 2
Summry of Epidemiological Study Findings Implicating PM and Acid Components of Air Pollution
(from Lippman and Thurston 1996)

Population	Health Effects Reported	Pollutants Monitored	Pollutants Associated with Adverse Outcome	Reference
Toronto: summer 1986-1988	↑ hospital respiratory admissions	TSP, PM_{10}, $PM_{2.5}$, O_3, H^+, H_2SO_4	**O_3, H^+** H_2SO_4	Thurston et al. 1994
New York State: Buffalo, Albany, Bronx, Westchester 1988-90	↑ hospital respiratory admissions in Buffalo and Bronx	O_3, H^+, H_2SO_4	**O_3, H^+** H_2SO_4	Thurston et al. 1992
Detroit Summers 1986-90	↑ hospital respiratory admissions	PM_{10}, O_3	**PM_{10}, O_3**	Schwartz 1994
Ontario Summers 1983-88	↑ hospital respiratory admissions	H_2SO_4, O_3	**O_3,** H_2SO_4	Burnett et al. 1994
Montreal summers 1984-88	↑ hospital respiratory admissions	PM_{10}, O_3, H_2SO_4	**PM_{10},** H_2SO_4	Delfino et al. 1994

Associations defined as $p \leq 0.05$; **boldface** indicates pollutants most highly associated with effects.

7. Concluding Comments on Biological Plausibility

Although Lippman and Thurston have not demonstrated causality, and indeed, clearly acknowledge that the "*the biologically active agent or agents in ambient PM that account for its associations with human mortality and morbidity remain unknown*", they have presented a cogent argument for careful and thoughtful analysis required, including consideration of alternative hypotheses, prior to attributing causality to PM *per se*. They caution that although there is coherence between measures of PM and various adverse outcomes, there is some urgency in selecting "*reliable and efficient metric of relevant exposure and health risk*" for the purposes of setting regulatory levels. We agree with their conclusions regarding causality and priority setting.

Although there are animal studies that can demonstrate outcomes consistent with many of those observed in epidemiologic studies, the etiologic agents that have been employed to induce such effects range from ultrafine particles to soluble metals to acids, albeit at very high doses. Several hypotheses have been proposed to explain the relationship between exposure to ambient air pollution and the increase in mortality and measures of morbidity observed in human studies, but they do not, to date, establish a clear biological mechanism for the role of PM in these adverse health outcomes.

We acknowledge that of the Hill criteria, biological plausibility may be the most difficult to satisfy, and further agree that it is not necessary to invoke a specific pathophysiological mechanism in order to establish causality. However, heeding Wyndar's caution that when the strength of association is weak, the role of biological plausibility takes on increasing importance, and also considering the potential alternative hypotheses that have been presented, we urge the USEPA not to assert a causal association between PM (or any size fraction thereof) and adverse health outcome at this time. If, for example, the acid component of the particulate fraction is responsible for morbidity, and the metal for mortality, imposing a $PM_{2.5}$ NAAQS will not necessarily result in the decrease in risk that is hoped for.

B. Coherence: Are the same effects, or types of effects, noted across different studies?

The coherence criterion flows naturally from the question of biological plausibility in that it asks whether the hypothesized causal association is compatible with pre-existing theory and knowledge derived from laboratory animal studies or controlled human studies, as well as epidemiologic observations. In other words, are the effects noted in laboratory animals and those observed in human volunteer and epidemiologic studies coherent with respect to physiological or toxicological outcome? Although the distinction between acute and chronic outcomes is not always clear, in general, acute health effects can be seen as increased illness, hospitalizations, and/or premature deaths from respiratory or cardiovascular effects. Chronic health effects include increased incidence and prevalence of respiratory illness including asthma, respiratory infections and inflammation, decreased lung function, adverse effects on host defense mechanisms including immune response, and mortality from cancer or non-cancer causes. Some of the endpoints that have been evaluated appear to have no proven clinical relevance, and may better be thought of as physiological markers of exposure (e.g., physiological changes in pulmonary mechanical function).

An argument has been made (Greenberg et al. 1997) that in order for air pollution or some component thereof to meet the criterion of coherence as described by USEPA, a progression of effects should occur with development of symptoms (incidence), progression (morbidity

prevalence), and finally, mortality. First, particulate air pollution, in isolation or in combination with other exposures, could cause a healthy individual to develop the onset of a new illness (increased incidence of morbidity in an exposed population). Second, particulate air pollution could influence the progression of the disease whose incidence had been increased, or some associated illness, causing already affected individuals to experience more severe or more persistent symptoms (progression or increased prevalence). In this context, particulate air pollution could affect the extent and duration of any disability and complicate the clinical management of the condition. Finally, particulate air pollution could operate at the terminal stages of illness, lowering the host's resistance and leading to premature death.

As discussed in detail in the preceding section, although in broad overview the coherence of effects is not inconsistent with exposure to some component of PM, there is no compelling evidence implicating $PM_{2.5}$ *per se* as the causal agent. In fact, it may be that some chemical moiety associated with $PM_{2.5}$, or PM in total, is responsible for the observed effects (if indeed, the effects do not attenuate as the result of the appropriate correction for co-exposure or characterization of individual exposure). As Greenberg et al. (1997) have indicated, the generally accepted observational approach among epidemiologists to study the development of new disease is to identify a cohort of non-diseased persons, with different levels of exposure, perhaps simply stratified on high/low exposure, and follow them for the development of disease. None of the published studies implicating PM (or any component of air pollution) have been analyzed in this fashion. Although the Six City study (Dockery et al. 1993) had data on baseline disease status, persons with existing illness were not excluded. Similarly, the generally accepted observational approach to studying the progression of illness is to identify a cohort of newly diagnosed persons, some of whom have higher exposure levels and some of whom have lower exposure levels, and follow them for the severity and duration of illness. Again, none of the published studies were analyzed in this manner. Greenberg et al. (1997) suggest USEPA consider such an analysis prior to asserting causality for PM; we concur with their recommendation.

Thus, at this time the conclusions that can be drawn regarding coherence are similar to those for biological plausibility: although arguments for coherence can be made, neither the existing data nor the available analyses have been developed sufficiently to establish coherence across the range of possible health outcomes that have been associated with PM exposure.

C. **Consistency**: Is there close conformity between the findings in different populations, locations, times, and when different methodologic approaches are employed for data analysis?

The difficulty in making conclusive statements regarding the strength of response lies in the extremely low levels of relative risk that have been observed, and in the potential confounding effects of copollutants, weather, and other potential causes of morbidity and mortality. We have previously discussed in detail the implications of the weakness of association, and the role that model choice plays in the attenuation of response. Until some resolution is made regarding the appropriate choice of model, and the strength of association can be stabilized across studies, the conclusion that the consistency criterion has been fulfilled should not be made.

Exposure differences contribute to the difficulty in resolving whether the consistency criterion has been met. Clearly, air masses differ across geographic regions: fine particles in the Northeast tend to have higher levels of sulfate than the western regions (47 per cent vs 15 per cent, respectively (Spengler and Wilson 1996); organic carbon comprises twice the proportion of particulate in the west than in the east. Yet, despite the heterogeneity of the particulate fraction and copollutants, measures of relative risk are approximately equal in the east and west. Further, as discussed previously, measures of individual exposure are very different from ambient monitors; how then is it possible to have consistent responses among individuals and across geographic regions?

Further, when different investigators evaluate the same (or nearly identical) data sets, different results are observed. As discussed earlier, the reanalyses of the Birmingham and Minneapolis-St. Paul studies indicate that a consistent response is **not** observed among three different groups of investigators. If a weight-of-the evidence approach were applied to these geographical areas, it would be difficult to conclude that there was an increase in hospital admissions associated with PM. Thus, we conclude that the consistency criterion has not been met.

D. Temporality: Does the exposure precede the effect?

Finally, we note that all of the studies associated with this issue meet the criterion of temporality: exposures precede outcomes. We note, however, that lag period optimization to yield statistically significant responses for some morbidity measures or mortality is not always consistent with biological modes of action that would predict such outcomes. For example, short lag periods (0-1 day) following exposures may not be inconsistent with lethality for individuals whose health is extremely compromised or are already near death. For mortality, however, with the exception of this group of individuals, it is difficult to believe that the 1-4 day lags cited in the literature are long enough to allow the development and expression of lethal diseases.

Further, the adjustment of lag time until the "best" fit demonstrating a positive association is obtained may be considered to introduce a positive selection bias. In other words, if statistical significance is attained only after the *a posteriori* consideration of intervals between exposure and outcome, the plausibility of the relationship between exposure and outcome is diminished, as is the degree to which the temporality criterion is met.

V. CONCLUSIONS AND RECOMMENDATIONS

The evidence for some factor associated with air pollution causing increases in mortality and morbidity is compelling by virtue of the repeated observations of small, but relatively consistent increases across a number of studies. However, at this time, there is insufficient evidence to make the causal association between exposure to PM, or $PM_{2.5}$ at current ambient air levels and adverse health outcome. This judgment is in substantial agreement with others that have appeared in print (Wolff 1996), Wilson and Spengler (1996), Gamble and Lewis (1996), Lipfert and Wyzga (1995a,b), HEI (1996), Moolgavkar and colleagues (1995-1997) and many others and is based on the following observations:

- The strength of the association between measures of air pollution, or any component of air pollution and adverse health outcome is very weak. Although several different types of mortality and morbidity studies have been performed (e.g., time-series, cross-sectional, prospective cohort mortality), where an increased risk is observed following exposure to some measure of particulate matter (e.g., TSP, PM_{10} or $PM_{2.5}$,) it is very small (relative risk ranges from approximately 1.06 to $\leq$ 1.5).

- When very weak associations are observed, regardless of their apparent consistency or coherence, additional emphasis must be placed on determining the potential role of confounders, exposure misclassification, measurement uncertainty, model specificity, and mechanisms to explain biological plausibility.

- Measurement uncertainty contributes to lack of confidence in the weak associations noted between measures of pollutants derived from central sampling stations and adverse health outcomes. The principle of ecological fallacy, which states that population measures do not accurately represent individual experiences, contributes to the lack of confidence in such measures.

- Although measures of exposure have been reasonably well-characterized for stationary ambient monitors, the body of evidence indicates that the correlations between outdoor measures and indoor measures of air pollution are highly variable, and depend on season, the construction of the home, and lifestyle of the occupants. Further, and perhaps more importantly, there is little to no correlation between ambient air measures and individuals'

exposures, particularly in the case of potential sensitive sub-populations (e.g., those suffering from COPD). It is not possible to extrapolate from regional monitors to individual experience, and therefore, to estimate individual risk.

- The ecological fallacy principle also applies to other risk factors. Thus, it is inappropriate not to take into account differences among population lifestyles, dietary habits, and health status when extrapolating from group characteristics to individuals.

- Because $PM_{2.5}$ is a heterogenous mixture of different chemical species arising from volatilized materials, PM precursors are not only sources, but also copollutants in contemporary air pollution. Statistical analyses attempting to attribute causality to any component of air pollution must consider the copollutants as covariates in the analyses.

- When such analyses are performed, the initial reports of statistical associations between PM and health outcome often attenuate, sometimes to the point of no significance. Other pollutants, e.g., ozone, SO_2, H^+, however, maintain robustness of association.

- Although exposures to high levels of pollutants have clearly caused death and respiratory distress in the past, there is no compelling biological or toxic mechanism that can explain the adverse health outcomes noted for current PM levels. Much research has been conducted to identify such mechanisms, but to date, no scientifically-defensible argument can be proposed to account for the effects observed in people exposed to current levels of air pollution.

- USEPA has not demonstrated that a reduction in $PM_{2.5}$ or PM_{10} will result in concomitant results of co-pollutants, although the Agency implies that setting such standards will result in overall improvements in air quality.

- Application of the Hill Criteria to these observations does not result in the attribution of causality to PM, and especially not to $PM_{2.5}$. In fact, alternative hypotheses involving other pollutants are equally, if not more, compelling.

With respect to the conclusion put forward by USEPA that the results observed are consistent with a causal association between PM2.5 and adverse health outcomes, we do not

believe that sufficient effort has been expended in the critical evaluation of alternative hypotheses to describe these effects.

The eminent philosopher of science, Karl Popper, believed that science is advanced only by testing hypotheses and discarding those that fail. In other words, before accepting an hypothesis as true, the experimenter must "bend over backwards" to exclude other explanations, or, to paraphrase Sherlock Holmes (in "*The Sign of Four*" by A. Conan Doyle), "when you have eliminated the impossible whatever remains, *however improbable*, must be the truth". Buck, in a discussion of the application of Popper's philosophy for epidemiologists (1975) adds that "This summarizes Popper's philosophy, except that 'must' in the last phrase should be altered to 'may'". Given the inability to maintain a consistent and robust association in the reanalyses of the major studies of morbidity and mortality, it is difficult to accept that the responsible pollutant for these effects is particulate matter, much less $PM_{2.5}$.

The overwhelming concern with respect to postulating a causal relationship between PM and adverse health outcomes is the implication for a new NAAQS. Clearly, if adverse effects are occurring, even at low levels of relative risk, the potential savings in terms of decreased morbidity and mortality may be significant because of the number of people exposed. Different numbers of "lives saved" and "diseases avoided" have been calculated by various groups including USEPA, with the sincere intent to avert health effects. However, given the number of municipalities that would be out of compliance by the imposition of these NAAQS, and the difficulty in meeting them, it is critical that the appropriate etiologic agent be identified, to insure that implementation of control technologies do indeed reduce mortality or morbidity (see also ENVIRON's comments on the Quantitative Risk Assessment, also submitted to the docket (ENVIRON 1997)).

Given the discussion presented in this set of comments, including the presentation of alternative hypotheses and models, we urge the Agency to consider carefully the implications of the imposition of the strict new NAAQS for $PM_{2.5}$. It is not apparent to us that decreasing levels of this pollutant component would positively affect rates of morbidity and mortality.

We urge USEPA to heed CASAC's recommendation: the Agency should immediately implement a targeted research program to address the uncertainties regarding key issues in attributing causality and the subsequent estimation of risk from PM, including long-term, reliable measurements of $PM_{2.5}$.

We further urge that the Agency solicit additional assistance and input from all stakeholders in the process to maximize data gathering (exposure and toxicity) and analysis so that unresolved questions regarding the identity and nature of the causative agent be more completely understood prior to recommending a new NAAQS for PM. By the next cycle of criteria pollutant review, sufficient data should be available to determine whether additional

control strategies for particulates, sulfates, NO_x, or metals, or as yet unidentified pollutants, will benefit the public health. If individual etiologic agents (or groups of agents) are identified, strategies that efficiently decrease emissions of those agents should be implemented to minimize the risk to the public health. Given the continually decreasing levels of air pollution in the US (USEPA 1997), this short delay should provide no increase in risk to the public, and may, by virtue of its improved precision, provide a more certain opportunity to improve it.

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ASSOCIATIONS OF PARTICULATE MATTER WITH ADVERSE HEALTH OUTCOMES: An Expert Panel Review of Causality Issues

Comments to USEPA on the Proposed National Ambient Air Quality Standards for Particulate Matter

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I. EXECUTIVE SUMMARY

The US Environmental Protection Agency recently concluded that new standards limiting annual and 24-hour average $PM_{2.5}$ levels should be added to the existing PM_{10} National Ambient Air Quality Standards for particulate matter. The proposed new standards have been the subject of significant debate among the regulatory, risk, and epidemiologic communities, primarily over the question of whether the reported associations between PM exposure and adverse human health effects are causal.

We have carefully reviewed and evaluated an exemplary sampling of the epidemiologic literature implicating PM exposure as a potential cause of increased morbidity and mortality in human populations. We have also attempted to identify gaps in the current literature that we believe must be addressed before informed causal inferences can be confidently made. Where possible, we have also identified additional information that could be gathered from existing data sources, and we suggest research strategies for filling gaps with new data in a short time.

From an epidemiologic perspective, one principal challenge to the assertion of causality is the remarkably weak level of the reported associations. Based on the criterion of strength of association, it is difficult to imagine a weaker case for causality than that posed by the data on particulate air pollution and mortality or morbidity. A second major challenge relates to the nature of PM exposure, which invariably occurs in combination with exposure to other air pollutants such as ozone, carbon monoxide, SO_2, H_2SO_4, metals, and volatile organics. Because this mixture's composition varies according to source, season, time of day, weather conditions, and geographic region, and because PM is itself a complex and highly variable mixture, it has been extremely difficult to disentangle the potential adverse health effects of PM, or a specific PM fraction, from those potentially attributable to other copollutants.

A traditional epidemiologic approach to sorting out confounded associations has been regression modeling of outcomes in relation multiple exposure variables and other possible confounders. However, most of the studies reporting significant PM associations have not included adequate adjustments for air pollution components other than PM presumably because of (1) incomplete availability of measurements on the copollutants, and (2) difficulties associated with estimation in the statistical models. Where adjustments have been made for more than one copollutant at a time, substantial reductions in the strength of the apparent PM association occurred and either a statistically non-significant result was obtained, or the result was said to be "significant," but not reported. In light of the relative paucity of estimates of the particulate-

health outcome association appropriately adjusted for other copollutants, any inference on the contribution of particulates or a specific fraction thereof is largely conjecture.

In all of the studies we reviewed, the level of exposure to particulates (and copollutants) was not based on personal dosimetry, but rather on samplers located in the various geographic areas. Individual subjects were thus assigned "community-wide" measures of exposure, rather than individual measures. The lack of personal exposure measures limits the ability to conclude that any individual death is linked to air pollution *per se*. In fact, there is a large body of data indicating that community sampler measurements rarely provide good estimates of individual exposures. Even if a causal association were to exist between exposure and disease occurrence at the individual level, such "ecological" exposure estimates may misrepresent the association's true strength. Equally important, the shape of the underlying causal dose-response relationship can also be significantly distorted by ecologic analyses.

In assessing whether the results from epidemiologic studies support the existence of a causal relationship between exposure and adverse health outcomes, criteria developed initially by Bradford Hill (1965) are often applied. These include the strength, consistency, coherence, specificity, and temporality of the association between exposure and disease. Although not explicitly stated, a presumption exists that the validity of the observed association has been established prior to consideration of these criteria, i.e., the estimates of the association's strength have been shown to be free of significant biases and not significantly confounded. The studies on air pollution and disease that we have evaluated do not satisfy these conditions; they have inadequately addressed potential biases and failed to resolve satisfactorily the issue of confounding.

Even if the issue of validity were ignored, the Hill criteria would not be met. The reported associations are extremely weak and vacillate between positive and negative based on the regression model used to characterize the relationship; as copollutants are introduced into the analyses, apparently positive associations attenuate in strength, often to non-significance. Further, the results of the studies are not actually as consistent as they might at first appear. For example, different exposure measures (e.g., mean daily level, maximum daily level, or some lagged estimate) have been associated with different endpoints (e.g., respiratory diseases, cardiovascular diseases, or total deaths). Temporal relationships between air pollution exposure and disease occurrence are not well established across studies, with lag times varying from concurrent day to several days earlier. Finally, an important component of coherence, dose-response, is, at best, weakly established in only a few studies.

The question of whether the coarse and/or fine particulate components of air pollution are causally related to adverse human health effects is one of great importance. If there is a causal

relationship, identification and establishment of a safe and acceptable level of ambient particulate matter will be a decision having enormous consequence. We have identified methodological issues that create a barrier preventing us from making a conclusive judgment about the causality of the association between PM exposure and adverse health effects. Given this assessment, we believe that the determination of a new regulatory limit for PM is premature.

We do feel, however, that research approaches currently exist which can bring the PM debate toward a more informed resolution and, hopefully, a consensus. First, there is an obvious need for focused, epidemiologic studies of air particulates and health effects that collect data at the individual subject level. Carefully designed case-control studies can also be effective. Finally, it is important that study designs be related to clearly articulated theories about the pathways through which particulate air pollution affects human health. In order to serve as a basis for regulatory decision-making, therefore, future epidemiologic studies will be most useful if they inform us about the specific manner in which individual air pollution constituents might affect human health. In our view, the current epidemiologic literature falls well short of this goal.

II. INTRODUCTION

The US Environmental Protection Agency (USEPA) has recently concluded that new standards limiting annual and 24-hour average $PM_{2.5}$ levels should be added to the existing PM_{10} National Ambient Air Quality Standards (NAAQS) for particulate matter (PM) (FR 61:65638-65713). This decision was based primarily on USEPA's assessment of the extensive epidemiologic literature on associations between PM exposure and the increased frequency of respiratory illness or symptoms (morbidity) and death (mortality). The Agency's assessment concluded that the "*consistency and coherence of the evidence across the studies*", along with the "*relatively small ranges of variability in the effects estimates observed in the body of studies*" ... "*are consistent with expectations based on assuming causal relationships between mortality and morbidity effects and PM exposure*".

The proposed new PM standards have been the subject of significant debate among the regulatory, risk, and epidemiologic communities because: (1) PM exposure is poorly characterized, with regional monitoring data serving as a questionable surrogate for individual exposures; (2) PM exposure is generally very low compared to the levels needed to induce adverse effects in controlled laboratory animal experiments; (3) the strength of the reported associations of exposure with adverse health effects is extremely low; (4) a plausible physiologic mechanism for the reported effects has yet to be convincingly demonstrated.

The literature on PM is complex, in large part because air pollution is an extraordinarily complex mixture. PM exposures occur in combination with exposures to other air pollutants (e.g., ozone, carbon monoxide (CO), SO_2, H_2SO_4, metals, and volatile organics), and the mixture's composition varies according to source, season, time of day, weather conditions, and geographic region. In fact, PM itself is a complex and highly variable mixture. Failure to adequately account for the strong multiple correlations among the various individual air pollution constituents and other potential confounders such as weather can lead to substantial bias in estimates of both the strength and statistical significance of associations between PM exposure and adverse health outcomes. Although USEPA has concluded that its estimates of effect for PM are robust to potential confounding by copollutants and weather, this conclusion is at variance with the findings of numerous recent reanalyses of earlier study data in which such variables have been considered in other than one-at-a-time fashion.

To address the underlying qualitative issue of whether the various associations that have been reported should be considered causal, we selected for critical review an exemplary group of publications that have implicated PM exposure as a potential cause of increased morbidity and mortality in human populations. We have also attempted to identify gaps in the current literature

that we believe must be addressed before informed causal inferences can be confidently made. Where possible, we have also identified additional information that could be gathered from existing data sources, and we suggest research strategies for filling gaps with new data in a short time.

III. SELECTION OF PUBLICATIONS FOR REVIEW

A large number of epidemiologic studies have been published in the last decade suggesting short-term increases in particulate air pollution are responsible for an increase in daily mortality rates, mainly from respiratory and cardiovascular causes. Some of the authors of these studies have also published comprehensive reviews of the subject (Dockery and Pope 1993, Ostro 1993) and generally have voiced support for a causal hypothesis (e.g., Dockery et al. 1992, Schwartz et al. 1996). Others have formed different conclusions from the same body of epidemiologic literature (Li and Roth 1995; Moolgavkar et al. 1995a,b, Moolgavkar and Luebeck 1996, Gamble and Lewis 1996; Davis et al. 1996). Because the body of scientific literature is large, yet the conceptual approaches, study designs, and statistical analyses used across the studies are quite similar, we reviewed a limited number of key articles that were judged to be representative of the body of published research.

First, nine papers were identified for detailed review; they are listed in Table 1. Six of these evaluated the possible association between short-term increases in particulate air pollution and daily mortality. Collectively, these papers include a variety of geographic areas (e.g., Europe and North America (Katsouyanni et al. 1990; Abbey et al. 1993, 1995a,b; Dockery et al. 1993; Kinney et al. 1991; Pope et al 1992; Styer et al. 1995), and study design (i.e., the ecologic time-series and cross-section studies and the partially ecologic cohort design (Dockery et al. 1993). Four papers that reported on the possible association between particulate air pollution and morbidity were also selected. One examined trends in hospital admissions among adults (Schwartz and Morris 1995, Ostro et al. 1993), the second examined acute effects of particulate pollutants on respiratory symptom reporting among children (Schwartz et al. 1994), and the third focused on long-term ambient concentrations of components of air pollution on respiratory symptoms of a non-smoking, adult population (Abbey et al. 1995a,b).

As part of this effort, we identified the common challenges faced by the researchers who tried to attribute specific health outcomes to the air pollutant exposures measured in the studies. Furthermore, the consequences of these methodological challenges were reviewed, in terms of their potential impact on causal inference.

In the second phase, the studies were reviewed in light of Hill's postulates of causality (Hill 1965) to determine whether they are fulfilled to a degree sufficient to conclude that a specific air pollution constituent is responsible for the observed health effects.

IV. FINDINGS

A. Weakness of Reported PM Association

From an epidemiologic perspective, one of the principal challenges in studying the relationship between particulate air pollution and mortality or morbidity is the remarkably weak level of association observed between these variables. For instance, in summarizing the findings of a series of studies, Ostro (1993) concluded that a 10 $\mu g/m^3$ rise in PM_{10} was associated with a 1% increase in mortality. Schwartz and Morris (1995) found that in Detroit a 32 $\mu g/m^3$ increase in PM_{10} was associated with a 1.8% increase in hospital admissions for ischemic heart disease. Kinney and Ozkaynak (1991) analyzed data from Los Angeles county and found that the combined influences of five measures of air pollution including particulates, along with temperature and humidity, could explain less than 4% of the daily variability in total mortality. Similarly, odds ratios were generally less than 1.5 in the morbidity studies which assessed the association between self-reported symptoms or hospitalizations and various measures of air quality (Abbey et al. 1993, Schwartz et al. 1994, Schwartz and Morris 1995).

This is not to say that small changes in total mortality/morbidity, if causal, are unimportant from a public health point of view. Rather, the issue is whether such an association is likely to be one of cause-and-effect. One of the time honored criteria for assessing whether epidemiologic asso[illegible]s are causal is the strength of association. Well established environmental hazards tend to ha[illegible]ch stronger associations than those reported between particulate air pollution and mortality and morbidity. Indeed, on the basis of strength of association, it is difficult to imagine a weaker case for causality than that posed by the data on particulate air pollution and mortality or morbidity.

Of equal concern, when studying such weak associations, is that fact that even a small amount of bias can produce a significant distortion of the actual relationship. This problem is well illustrated by the previously cited analysis of pollution data in Los Angeles county (Kinney and Ozkaynak 1991). In a regression model that adjusted only for the influence of total oxidants and temperature, the indicator of particulate air pollution was significantly associated with an increase in overall mortality. In a fuller model, however, with additional adjustment for the effects of sulfur dioxide, carbon monoxide and nitrogen dioxide, the association of mortality with particulates became non-significant statistically, with even a reversal in sign of the PM regression coefficient (i.e., particulates appeared to reduce mortality). Of course, it is unlikely that particulate air pollution actually reduced mortality.

What is clear, however, is that the association under investigation is so weak that reasonable changes in model specification can cause the association's strength to reverse direction

from an apparent harmful to an apparent beneficial effect. In a morbidity study of Seventh Day Adventists, adjusting ambient air concentrations for time spent indoors reduced most relative risk estimates by 50% (Abbey et al. 1993). Similar adjustments were not done in most of the other studies because of the absence of relevant data. The Health Effects Institute (HEI) analysis of mortality data (1974-88) in Philadelphia found that the effects of total suspended particulate (TSP) and SO_2 were lower when they were considered together than when they were included alone in models (Samet et al. 1996). This reanalysis also showed significant effect modification between TSP and season. Many of the other studies that we reviewed did not even take season into account.

B. Components of Air Pollution Difficult to Untangle

It is well recognized that air pollution tends to be a complex mixture of substances. Although one can find unusual circumstances where particulate air pollution is not accompanied by appreciable levels of other pollutants (e.g., Utah Valley, Pope et al. 1992), particulate levels are typically highly correlated with other pollutants. For example, in the widely cited "Six Cities Study," the location with the highest mean particulate air pollution level (Steubenville, Ohio), also had the highest mean levels of sulfur dioxide and nitrogen dioxide (Dockery et al. 1993). In this same study, the city with the lowest mean particulate levels (Portage, Wisconsin), also had the lowest mean levels of these two other pollutants. Daily levels of particulate air pollution in Los Angeles (Kinney and Ozkaynak 1991) were highly correlated with those for sulfur dioxide, carbon monoxide, and nitrogen dioxide (correlation coefficients for filtered variables: 0.68, 0.82, and 0.88, respectively). High correlations among pollutants also were observed in morbidity studies (Schwartz et al. 1994, Schwartz and Morris 1995). The difficulty in identifying one pollutant as responsible is exemplified in the Philadelphia mortality study where the authors (Samet et al. 1996) concluded:

> "Our findings indicate that a single pollutant of the group TSP, SO_2, NO_2 and CO cannot be readily identified as the best predictor of mortality, because concentrations of the four pollutants were moderately correlated in Philadelphia during the years of the study.".

Relatively few studies have evaluated more than two pollutants simultaneously. Residual confounding could therefore account for the findings in some studies, such as the morbidity study in Detroit (Schwartz and Morris 1995).

The overlap of exposure to various copollutants may not be of great concern if one is simply trying to evaluate whether "air pollution" as an undifferentiated whole has adverse health

effects. Indeed, the use of levels of a specific air pollution constituent, or preferably a combination of the constituents, may serve as a very effective surrogate for overall air pollution. The fact that the components tend to be highly correlated in most urban, industrial settings, suggests that any overall effect may be well represented by one or more components. On the other hand, if the goal is to separate out the independent effects of individual components, so that they may be efficiently regulated, the high degree of correlation between pollutants presents a very real challenge.

The traditional approach to sorting out associations between several exposures and a specific health outcome is to construct a multivariate regression model, with the multiple exposures as separate explanatory variables and the health outcome as the response variable. As shown in Table 2, most of the papers we reviewed did not include appropriate adjustment for other typical components of air pollution. Presumably, the principal reasons for not including these correlated components of air pollution in the estimating models were: (1) incomplete availability of measurements on the other exposures, and (2) difficulties associated with estimation in the statistical models (see, for example, Schwartz et al. 1996). In the reviewed mortality studies where adjustments were made for more than one other type of pollutant, reductions in the apparent association with particulates occurred, and either a statistically non-significant result was obtained for particulates, or the result was said to be "significant," but not reported.

In light of the relative paucity of estimates of the particulate-health outcome association appropriately adjusted for other pollutants, any inference on the contribution of particulates or a specific fraction thereof is largely conjecture. It might even be argued that it is beyond the ability of observational research methods to completely disentangle the health-related effects of various components of air pollution. An analogy can be made to the numerous epidemiologic studies of personal cigarette smoking and risk of lung cancer. Cigarette smoke, like air pollution, is a complex mixture of substances. Although epidemiology has proven capable of sorting out the overall health hazards of smoking, and toxicologic data point to particular components of cigarette smoke that may be hazardous, epidemiologic methods have not been particularly useful for singling out a particular harmful component of cigarette smoke. As long as the individual components of cigarette smoke remain highly correlated, it is difficult, if not impossible, to sort out the individual contributions of various components to ill-health.

The issue of confounding, is not limited in the present context to air pollution components alone. Air pollution is only one of a number of environmental factors, both naturally occurring and man-made, that can affect human health. It has been well recognized, for example, that extremes of ambient temperature can increase human mortality (Kunst et al. 1993). As shown in Table 3, most but not all of the selected mortality studies included some attempt to control for the

effects of temperature; humidity also was controlled in half of these studies. On the other hand, other naturally occurring environmental factors that affect morbidity and mortality, such as pollen count and infectious disease outbreaks, were not directly considered in these analyses.

If these other environmental factors operated in total isolation from the effects of air pollution, then the omission of these exposures from the estimating models would not be a great concern. There is strong reason to believe, however, that the effects of these other environmental factors are relevant to an accurate characterization of the effects of air pollution. As respiratory events are important morbidity and mortality end-points for most of these studies, every effort should be made to consider the effects of other environmental agents known to influence respiratory function. Both allergens and infectious illnesses fall into this category, and surveillance data are widely available on both of these types of pathogen allowing appropriate inclusion in regression models. It is also worth noting that Lipfert and Wyzga (1995a) have shown that a sedentary lifestyle, a known risk factor for cardiovascular diseases, correlated well with the mortality rate ratios observed in the Six Cities Study.

C. Inadequate Consideration/Characterization of Exposure

In all of the reviewed studies, the level of exposure to particulates (and other air pollutants) was not based on any personal dosimetry, but rather on samplers located in the various geographic areas. Individual subjects were thus assigned "community-wide" measures of exposure, rather than individual measures. The variation of these community measures was then compared with variation in morbidity or mortality across communities, or within communities over time.

This basic approach has important advantages in that it is efficient and cost-effective. Often these studies can be completed quickly because they are based upon already available data. On the other hand, there are important limitations to assigning exposure information in this way. First, the occurrence of exposure and disease is not necessarily linked in individuals: the persons within a community who are most heavily exposed to particulates may not be the ones developing the disease(s) of interest, even if more adverse health outcomes occur on days of high pollution or in areas of high pollution. It is well known in epidemiology that ecologic associations can appear without any underlying link between the actual exposure and disease in individual persons. This phenomenon is referred to as the *ecologic fallacy*, and is a source of potential bias in studies that rely upon aggregates of persons as the unit of analysis (see Kelsey et al. 1986).

Even if a causal association were to exist between the exposure and disease occurrence at the individual level, the ecologically apparent association may misrepresent the true strength of the relationship. Equally important, the true shape of the causal dose-response relationship

between exposure and disease can be significantly distorted by ecologic analyses (see Hennekens and Buring 1987).

Fixed site monitoring stations were used to collect exposure data in all of the morbidity and mortality studies reviewed here (Table 1). The monitors varied in number over the duration of the studies, and their location within the study communities did not represent the optimal areas where exposure to the study populations occurred. For example, in the Detroit study, air pollution data were extracted from the EPA's aerometric data bank which obtained data on PM_{10} from two monitoring stations in 1986, seven in 1988 and four in 1989 (Schwartz and Morris 1995).

Even in the only reviewed mortality study employing a cohort design (i.e., the Six Cities Study), measures of particulate exposure were still based on population-level monitoring. It has been suggested by the investigators of this study that central monitors adequately characterized a total community's exposure (Dockery et al. 1993). These investigators, however, did not provide data from multiple monitoring stations within individual communities to demonstrate the purported uniformity of measures. In fact, it seems quite likely that in at least some metropolitan areas, there are higher pollution levels within the inner city from heavy automobile traffic and industrial activity, contrasting with lower pollution levels in the surrounding suburban areas. As a consequence, measures of air pollution from single monitoring stations might either systematically over-estimate or under-estimate actual exposure levels for individual subjects. Personal exposure levels also are likely to be influenced by the amount of time a subject spends out of doors and by their general health status. In these complicated multi-variate situations, it is unclear whether misclassification of exposure levels served to distort the apparent relationship between particulate pollution and health outcomes. The lack of personal measures of exposure limits the ability to conclude that any individual death is linked to air pollution *per se*.

In fact, there is a large body of data indicating that community sampler measurements rarely provide good estimates of individual exposures. The early study of Spengler et al. (1981) demonstrated that there was almost no correlation between exposure to PM_{10} (as measured by ambient samplers) and personal exposures in the cities included in the Six Cities Study data set of Dockery et al. (1993). For example, in each of the cities except Steubenville, indoor exposures to respirable particulate (i.e., PM_{10}) significantly exceeded outside exposures. Moreover, the presence of a smoker in the house provided the dominant source of indoor air pollution. Homes with one smoker had mean increases in indoor particulate by 12 $\mu g/m^3$; two or more smokers increased the mean by 46 $\mu g/m^3$. Other contributors to the level of indoor particulate were seasonality, activity levels, air conditioning, and ventilation. Thus, outdoor ambient monitors poorly represent the qualitative and quantitative nature of personal exposures.

More recently, Özkaynak et al. (1996) evaluated personal exposures to particles and metals in Riverside, California. Exposures from ambient monitors were compared with outdoor concentrations near homes (backyard samples), which were then compared with measurements from stationary indoor and individual samplers worn by study participants. The results indicated that central and backyard measurements were reasonably well correlated, implying that quantitative estimates of particulate mass (expressed as PM_{10}) were reasonably well-correlated. Particle samplers worn by individuals over the course of the day, however, indicated that an excess mass of particles or "personal clouds" were experienced by the participants. Population-weighted daytime personal PM_{10} exposures were 150 ± 9 (SEM) $\mu g/m^3$, compared with concurrent indoor and outdoor concentrations of 95 ± 6 $\mu g/m^3$. The authors concluded that although outdoor concentrations of particulate near homes were well correlated with central site measurements, indoor concentrations were only weakly correlated with outdoor concentrations, and "*personal exposures were even more poorly correlated with outdoor concentrations*".

With respect to individuals with compromised respiratory function, in preliminary work Koutrakis (1997) has observed poor correlations between personal exposure to PM_{10} or $PM_{2.5}$ and outdoor measures, with lower correlation in winter, when houses tend to be closed, than in summer. These studies were conducted with volunteers suffering from chronic obstructive pulmonary diseases (COPD), populations likely at highest risk of morbidity (exacerbation of symptoms) or mortality.

D. Dose-response

One of the critical criteria for assessing whether an observed association is likely to be causal is whether there is a dose-response gradient. The tendency for risk of adverse health effects to rise with increasing level of particulate exposure would provide support for a causal interpretation. As shown in Table 4, all but one of the mortality studies we reviewed included an evaluation of dose-response. Most, but not all, of the studies that examined this issue found at least some supporting evidence.

Some investigators have argued that there is no threshold below which inhalable particulate air pollution ceases to cause increased mortality (Schwartz et al. 1996). This is a fundamental concern from a regulatory perspective as it implies that any non-zero level of air pollution will cause at least some adverse health effects. As indicated in Table 4, however, two of the four mortality studies that assessed the shape of the dose-response relationship found some supporting evidence for a PM_{10} threshold, with the no effect level approximately equal to the previously established average annual average regulatory standard level of 50 $\mu g/m^3$. The reanalysis of Philadelphia data conducted by the HEI (1996) also provided evidence of a non-linear dose-response relationship, again with the rise in mortality confined to PM_{10} levels above about 50 $\mu g/m^3$.

E. Health End-points

In the selected mortality studies, the investigators tended to evaluate "overall" deaths, as well as cause-specific deaths, especially those attributed to cardiovascular or respiratory causes. In the time-series analyses, deaths of non-residents were typically excluded, although there is little reason to do so as their immediate exposure to air pollution is the same as that for residents. Deaths from accidents also were excluded from many of the studies, although it is not immediately apparent to us that air pollution should be relevant only to non-accidental deaths.

There is logic in focusing on death from respiratory disease, however, because inhaled particulates potentially could affect respiratory function. A link to cardiovascular deaths is also possible through further compromise of oxygenation among patients with heart failure (Schwartz and Morris 1995). As shown in Table 5, most, but not all, of the selected mortality studies revealed an effect on overall mortality. Furthermore, where associations were seen with overall mortality, generally there were associations with respiratory and cardiovascular mortality. The selected morbidity studies have shown some similar consistencies for the respiratory Abbey et al. (1993) and cardiovascular outcomes (Schwartz and Morris 1995).

The use of mortality as an end-point has certain advantages in that the data are easily accessible, generally complete, and standardized in classification across regions. On the other hand, data collected from death certificates have important limitations. Often the certifying physician has minimal knowledge of the patient, and the actual cause of death may be misassigned, especially when the certifying physician was not present at the time of death. In none of the selected mortality studies was there any attempt to try to validate at least a subsample of the assigned causes of death.

Moreover, the studies of air pollution and mortality have not included any information about the clinical events around the time of death for the deceased subjects. The lack of information on the circumstances surrounding these "excess" deaths has left open the question of whether they are attributable to the air pollution *per se*, or whether these individuals were chronically ill and their deaths were simply advanced in time by the additional physiologic stress of the air pollution. The phenomenon of hastening the death of terminally ill patients has been referred to as "harvesting" (Kunst et al. 1993,Spix et al. 1994). Although any reduction in life-expectancy is a potential matter for public health concern, if the deaths are occurring only days or weeks before they otherwise would occur, then the public health impact of this "excess mortality" would be comparatively small. It would be much more beneficial, from a public health perspective, to address the underlying causes of respiratory and cardiovascular compromise in these individuals. Because cigarette smoking is by far the leading cause of chronic obstructive pulmonary disease, and few non-smokers develop or die from this disease, it would be of interest to know what proportion of the "excess" deaths attributed to air pollution occurred among non-smokers. It is likely that this percentage is very small, and that a more effective strategy for preventing these deaths is to promote smoking cessation.

V. CONCLUSIONS AND RECOMMENDATIONS

A. Overall Conclusions

Many studies have evaluated the associations between air pollution and morbidity and/or mortality. The authors of most of these studies have concluded that there is a positive association between one or more measures of air quality and some indicator of disease status. The evidence, at first blush, appears substantial and persuasive, leading many to conclude that a causal relationship has been established and that sufficient data exist to recommend new policies regarding air quality standards. Many of the study authors have stated that their results are consistent with others and that the body of literature overall represents consistent findings. Indeed, there are many consistencies that buttress the causal argument. On closer scrutiny, however, one notices many disquieting inconsistencies and methodological problems that raise serious questions, particularly in view of the relatively small risks (typically ≤ 1.25) reported in the studies. Such risks could readily be accounted for by uncontrolled confounding, effect modification, invalid measures of exposure or outcomes, information bias, model specification bias, or inappropriate analytical methods.

In assessing whether the results from epidemiologic studies support the existence of a causal relationship between exposure and adverse health outcomes, criteria developed initially by Bradford Hill (1965) are often applied. These include the strength, consistency, coherence, specificity, and temporality of the association between exposure and disease.

Although not explicitly stated in most applications of these criteria, a presumption exists that the validity of the observed association has been established, i.e., the studies have already been shown to be free of significant biases, and the association has already been shown not to be significantly confounded. The studies on air pollution and disease that we evaluated do not satisfy these conditions; these studies have inadequately addressed potential biases and have failed to satisfactorily resolve the issue of confounding.

For example, to address concerns related to previous ecological studies, the authors of the "Six Cities" study collected individual data on potential confounders such as active smoking, social class, body mass, education, and occupation, but found the significant associations between $PM_{2.5}$ and SO_2 exposure and mortality to persist. Likewise, in their prospective study of ACS respondents, Pope et al. (1995) corrected for age, sex, race, active and passive smoking, education, body mass, alcohol consumption, and some occupational exposures; the significant associations between $PM_{2.5}$ and SO_2 and mortality persisted.

However, when Lipfert and Wyzga (1995b) reanalyzed some of these data to demonstrate that the "ecological regressions" were highly dependent on the covariates included in the regression, different conclusions were reached. As variables related to socioeconomic status were entered into their regression analyses, the relative contribution of pollutant exposures decreased to non-significance. Lipfert and Wyzga suggest that had the original investigators included these variables in their analyses, similar conclusions might have been reached (i.e., failure to systematically consider individual risk factors allowed for the persistence of apparent associations between exposures to air pollutants and increased mortality). In an earlier paper, Lipfert and Wyzga (1995a) also showed that the mortality rate ratios in the Six Cities Study correlated well with data on sedentary lifestyle, a known risk-factor for cardiovascular diseases.

Even if the issues of validity are ignored, the Hill criteria would not be satisfied. As stated previously, the criterion of strength of association is not met. The reported associations are extremely weak and vacillate between positive and negative based on the regression model used to characterize the relationship; as copollutants are introduced into the analyses, apparently positive associations attenuate in strength, often to non-significance. Further, the results of the studies are not actually as consistent as they might first appear. For example, different exposure measures (e.g., mean daily level, maximum daily level, or some lagged estimate) have been associated with different endpoints (e.g., respiratory diseases, cardiovascular diseases, or total deaths). Time relationships between air pollution exposure and disease occurrence are not well established across studies, with lag times varying from concurrent day to several days earlier. Finally, an important component of coherence, dose-response, is, at best, weakly established in only a few studies.

Further research needs to address some of the methodological and analytical issues not adequately addressed in earlier studies. In particular, more attention should be directed to appropriate selection of analytical methods for ecological studies, the assessment of measurement error in exposure, and consideration of potentially important confounder such as weather variables. Until these issues are resolved, revisions in standards should proceed cautiously.

B. Whither Hence...

The question of whether the coarse and/or fine particulate components of air pollution are causally related to adverse human health effects is one of great importance. If there is a causal relationship, identification and establishment of a safe and acceptable level of ambient particulate matter will be a decision having enormous consequence. In the preceding sections we have identified five methodological issues which create a barrier preventing us from making a conclusive judgment about the causal relationship. Given this assessment, we believe that the

determination of an appropriate level is premature. We do feel, however, that research approaches currently exist that can bring the debate toward a more informed resolution and, hopefully, a consensus.

First, there is an obvious need for focused, epidemiologic studies of air particulates and health effects that collect data at the individual subject level. Although we acknowledge the benefits, in terms of cost and time, of linking routinely collected population exposure data (i.e., fixed-source air monitoring data) and widely available population morbidity and mortality data (e.g., death certificate tapes, hospital admission data), this is not an adequate substitute for studies that link and analyze data from individual subjects. John Snow would likely have missed identifying contamination of the Thames river as the source of the famous London cholera outbreak had he not studied individual households to learn their specific patterns of accessing well water. Even though the microbiologic contamination of the water was fairly pervasive throughout the city's population, there was sufficient heterogeneity in the exposure distribution to require more detailed data. Future research must be able to demonstrate that the individuals suspected of suffering increases in the risk of illness and mortality were actually exposed to fine or coarse particulates at levels putatively believed to cause harm.

A recent comprehensive and detailed WHO report promoting the linkage of ecologic data for analyzing the health effects of environmental hazards, states

> "...it is important to emphasize that the aim of linkage analysis is not to discover new associations, nor to confirm suspected ones, but to use existing knowledge to assess the risks which exist, to identify need for action, to compare and evaluate the choices available, and to monitor and assess the effects of such action" (Nurminen and Briggs 1996).

Yet, in the present case of particulate air pollution, linkage analyses have formed the major basis for establishing and confirming the association in the eyes of those who support it. The important uncertainties which currently exist can be substantively addressed by undertaking a modest number of carefully planned cohort studies which recruit and follow defined population cohorts.

Carefully designed case-control studies can also be effective, especially if it is hypothesized that the health effects reflect an acute response to particulate pollution. One variant of this design with possible relevance is the case-crossover design. In this design cases serve as their own controls (Maclure 1995). Applied to the particulate air pollution context, pollutant levels on the day (or days) before death or hospital admission of an individual would serve as the

conventional "case exposure." This could be linked to specific geographical and activity data about the individual during the same time frame. Pollutant levels on a day (or the average of several days) for a period before the death (e.g. same day, one week before), coupled with personal activity data, would serve as the "control exposure." Analogous information on temperature and other possible confounders would be ascertained for the same time frame. This design has been used successfully to investigate the association between transient risk factors and health events.

Finally, it is important that study designs be related to clearly articulated theories about the pathways through which particulate air pollution affects human health. For example, one can envision several distinct causal pathways to the development and progression of illness. These are represented schematically in Figure 1. First, particulate air pollution, in isolation or in combination with other exposures, could cause a healthy individual to develop a new illness. If this were hypothesized, studies should be designed to compare the incidence of disease in populations exposed to varying degrees. Secondly, particulate air pollution could influence the natural history of illness in individuals, causing individuals already ill to experience more severe or more persistent symptoms. Particulate air pollution would then affect the extent and duration of disability and complicate the clinical management of the condition; these outcomes should then be studied. Finally, particulate air pollution could operate at the terminal stages of illness, lowering the host's resistance and leading to premature death. If this were hypothesized it would be appropriate to compare death rates (or time to death) of different groups of persons in advanced stages of illness who have varying exposure to particulate pollution.

Of course, these three pathways are not necessarily mutually exclusive; particulate air pollution could affect incidence, severity of illness, and eventual fatality. Some might even argue that it is not necessary to distinguish between these modes of operation, as they all constitute potential areas of concern for public health. From a regulatory point of view, however, it is not clear that they are all of equivalent public health importance, nor that they occur at similar dose levels. In order to serve as a basis for regulatory decision-making, therefore, future epidemiologic studies will be most useful if they inform us about the specific manner in which individual air pollution constituents might affect human health. The current epidemiologic literature falls well short of this goal.

[email version of Figure 1]

	1		2		3	
Healthy Person	---->	**Newly Diagnosed Illness**	---->	**Persistent, Severe Illness**	--------->	**Death**
	Incidence		*progression*		*~fatality~*	

Table 1
Studies Evaluated by Expert Panel

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Table 2
Attempt to Adjust for Other Air Pollutants in Selected Analyses of Particulates and Mortality

	Other Pollutants					
Reference	**SO_2**	**NO_2**	**CO**	**O_3**	**H^+**	**Total Oxidants**
Katsouyanni et al. (1990)[1]	N	N	N	N	N	N
Kinney and Ozkaynak (1991)	Y	Y	Y	N	N	Y
Pope et al. (1992)	N	N	N	N	N	N
Dockery et al. (1993)	Y	Y	N	Y	Y	N
Styer et al. (1995)	N	N	N	N	N	N
Schwartz et al. (1996)	N	N	N	N	Y	N

[1] Adjusted particulate effect not statistically significant.
[2] Adjusted particulate effect not provided, but reported as statistically significant.

Table 3
Attempt to Adjust for Other Environmental Characteristics in Selected Analyses of Particulates and Mortality

	Environmental Characteristics			
Reference	**Temperature**	**Humidity**	**Pollen Count**	**Infectious Outbreaks**
Katsouyanni et al. (1990)	Y[1]	N	N	N
Kinney and Ozkaynak (1991)	Y	Y	N	N
Pope et al. (1992)	Y	Y	N	N
Dockery et al. (1993)	N	N	N	N
Styer et al. (1995)	Y	Y	Y[2]	N
Schwartz et al. (1996)	Y	N	N	N

1 By matching ± 4° C
2 For one study area only.

Table 4
Assessment of Dose-response in Selected Studies of Particulate Air Pollution and Mortality

	Dose-Response		
Reference	**Evaluated**	**Increasing**	**Threshold**
Katsouyanni et al. (1990)	N	NA[1]	NA
Kinney and Ozkaynak (1991)	Y	N	NA
Pope et al. (1992)	Y	Y	Y[2]
Dockery et al. (1993)	Y	Y	N
Styer et al. (1995)	Y	+/-[3]	Y[4]
Schwartz et al. (1996)	Y	Y	N

[1] NA= not assessed
2 Mortality increased only above PM_{10} of 40 $\mu g/m^3$
3 Trend seen in one of two locales
4 In Chicago during Spring, mortality increased only above PM_{10} of 50 $\mu g/m^3$

Table 5
Demonstration of a Statistically Significant Association Between Particulate Air Pollution and Cause-Specific Mortality after Adjustment for Other Pollutants in Selected Studies

	Type of Mortality		
Reference	**Overall**	**Cardiovascular**	**Respiratory**
Katsouyanni et al. (1990)[1]	Y	N	Y
Kinney and Ozkaynak (1991)	N	N	N
Pope et al. (1992)	Y	Y	Y
Dockery et al. (1993)	Y	← Y[2] →	
Styer et al. (1995)	N	N	N
Schwartz et al. (1996)	Y	Y	Y

[1] Pollution variable based on SO_2, not particulates.
[2] Cardiovascular and respiratory death not reported separately.

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PREPARED STATEMENT OF SUSAN E. DUDLEY, VICE PRESIDENT AND DIRECTOR OF ENVIRONMENTAL ANALYSIS, ECONOMICS INCORPORATED

Good Morning. My name is Susan E. Dudley. I am Vice President and Director of Environmental Analysis at Economists Incorporated, a consulting firm in Washington, DC. I am pleased and honored to be here before you today to discuss the risk assessment underlying the Environmental Protection Agency's proposed national ambient air quality standard (NAAQS) for ozone.

My understanding of the health and welfare risks of the proposed ozone NAAQS is based on an analysis of the proposed rule and its accompanying regulatory impact analysis (RIA) that I conducted for the Regulatory Analysis Program (RAP), a research and educational program at the Center for Study of Public Choice at George Mason University. RAP is dedicated to advancing knowledge of regulations and their impact. As part of its mission, the program produces careful and independent analysis of agency rulemaking proposals from the perspective of the public interest. I am grateful to Dr. Wendy Lee Gramm, the director of RAP, for her intellectual and financial support in the preparation of the comments submitted to EPA. RAP's comments on the proposed ozone NAAQS, and its accompanying comments on the particulate matter NAAQS[1] are available on Economist Incorporated's web site: http://www.ei.com.

This morning, I would like to highlight some of our most important concerns with the risk assessment underlying EPA's ozone proposal.

1. There is little scientific basis for the selection of the standard

EPA recognizes that the selection of the standard was a policy decision, rather than a scientific decision. EPA's science panel did not find the proposed standard to be significantly more protective of public health than the current standard, and most members who expressed an opinion preferred a level less stringent than that which EPA has proposed.

2. EPA's preamble and RIA suggest that the health and welfare benefits expected from implementation of the proposal are small and highly uncertain

The effects of ozone on the general population appear to be transient, reversible, and generally asymptomatic. Even for the population at the greatest risk, those with pre-existing respiratory conditions, the expected impact of the proposed change in ozone levels is small. With full implementation of the rule, EPA predicts a 0.6 percent decrease in hospital respiratory admissions for asthmatics. Furthermore, EPA's evidence from chronic animal studies suggests that long-term exposure to ozone does not affect lung function.

3. As a result of EPA's narrow interpretation of its mandate to protect public health, this proposal may actually harm public health and welfare

EPA appears to focus on the impact of ozone on at-risk populations, particularly children with existing respiratory conditions such as asthma. While asthma is a disturbing health problem, particularly since (a) reported cases have been increasing in recent years (45 percent in the last decade), (b) one-third of its victims are children, and (c) it is most severe among the urban poor, this trend cannot be explained by ozone levels; air quality has been improving over the last decade and ozone levels in particular declined 6 percent between 1986 and 1995.[2] Recently, the National Institute of Allergy and Infectious Diseases funded a study that revealed that "the leading cause of asthma by far was . . . proteins in the droppings and carcasses of the German cockroach."[3] The American Thoracic Society concluded:

> Poverty may be the No. 1 risk factor for asthma. . . . As with many of the health problems facing society today, education and prevention are the keys to controlling asthma in the inner city.[4]

Thus, even if asthma were the only public health issue of concern, the proposal may have a perverse effect on health. The potential impact on those afflicted with the disease is very small, and the costs of the rule will drain society's resources from more effective remedies.

Perhaps even more disturbing is EPA's analysis (not presented as part of this rulemaking) that suggests that the proposed standard would increase health and welfare risks from ultra-violet radiation. Ground-level ozone has the same beneficial

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[1] Thomas D. Hopkins, Ph.D, Arthur J. Gosnell Professor of Economics, Rochester Institute of Technology prepared RAP's comments on the PM NAAQS.

[2] USEPA, *National Air Quality and Emissions Trends Report, 1995.*

[3] Chemically Speaking, July 1996.

[4] American Thoracic Society, 1996 Conference Articles.

screening effects on ultraviolet radiation as stratospheric ozone. Based on EPA analysis used to support earlier rulemakings to protect stratospheric ozone, it appears that the proposed 10 ppb change in the ozone standard could result in 25 to 50 new melanoma-caused fatalities, 130 to 260 incidents of cutaneous melanoma, 2,000 to 11,000 new cases of nonmelanoma skin cancer, and 13,000 to 28,000 new incidents of cataracts each year. These negative health effects of the proposal could vastly outweigh the positive health effects attributed to it in the RIA. By converting all health effects into a dollar metric, we estimate that attainment of the proposed standard could actually increase health risks by over $280 million per year.

When the costs of the proposal are considered, the negative impact on public health is even more dramatic. If, as recent studies suggest, poverty is a more important risk factor for asthma than air quality, the rule may well increase the very disease it is purportedly targeted at improving. Moreover, studies linking income and mortality suggest that the cost of this proposal would, by lowering incomes alone, result in an increase in 4,250 to 5,667 deaths per year.

EXECUTIVE SUMMARY

The Regulatory Analysis Program offers the following conclusions and recommendations regarding EPA's proposed revision to the ozone National Ambient Air Quality Standard (NAAQS) and the accompanying Regulatory Impact Analysis (RIA).

A. The proposal will not improve public health and welfare

EPA interprets the Clean Air Act to prohibit the consideration of costs in setting NAAQS. Even if one were to accept EPA's interpretation of its statute, EPA appears to have ignored important public health and welfare considerations.

There is little scientific basis for the selection of the standard, and the health and welfare benefits attributed to the proposal are small and highly uncertain. Moreover, EPA has chosen not to consider important risk information relevant to public health and welfare, arguing that the statute only allows it to consider the negative impacts of chemicals, not their positive impacts.

As a result, EPA's proposal may harm public health and welfare, regardless of cost. For example, the potential for a change in the ozone standard to increase people's exposure to ultraviolet radiation raises serious questions about the net health and welfare effects of this proposal. Taking into consideration the beneficial screening effects of ozone on ultraviolet radiation, we estimate that the impact of attaining the proposed standard would be to increase health risks by over $280 million per year. This is particularly disturbing in light of the enormous costs full attainment of this rule would impose on every aspect of our lives.

When the costs of the proposal are considered, the negative impact on public health is even more dramatic. If, as recent studies suggest, poverty is a more important risk factor for asthma than air quality, the rule may well increase the very disease it is purportedly targeted at improving. Moreover, studies linking income and mortality suggest that the cost of this proposal would, by lowering incomes alone, result in an increase in 4,250 to 5,667 deaths per year.

EPA has a responsibility for setting NAAQS that protect public health and welfare. To fulfill that responsibility it cannot ignore important health and welfare effects which can be readily, and reliably, quantified.

B. EPA's regulatory impact analysis does not provide an adequate basis for making a sound policy judgment

According to EPA's own RIA, the costs of the proposal will exceed the benefits. Furthermore, questionable assumptions and serious omissions in the RIA lead to an understatement of costs. EPA admits that "aggregate total costs underestimate the true cost of each alternative to such an extent that the metric's reliability must be limited." EPA estimates the cost of only partially complying with the current and proposed standards. EPA does not include the costs of regional controls in its estimates of either the current or proposed ozone NAAQS. EPA also assumes that areas that can achieve ozone concentrations that are only 64 percent of the standard will incur no costs. As a result of these deficiencies, our analysis suggests that EPA's cost estimates reflect less than 5 percent of the true full costs of attainment.

Modeling, exposure, and valuation constraints make EPA's benefit estimates very uncertain. CASAC observed that due to the compounded uncertainties in the approach to estimating welfare effects, "small differences in benefits may have no significance . . ." EPA places its best (i.e., most likely) estimate of the incremental health benefits of the proposed standard is at the low end of its range, between $11 million and $108 million.

According to EPA, more than 98 percent of its total estimated health benefits come from reduced mortality, not the other health benefits EPA relies on to support its proposal. However, this estimate of reduced fatalities is based on a single study that was not discussed in the criteria document or staff paper, and thus not reviewed by EPA's science advisory committee (CASAC).

C. The costs of the proposed standard are strikingly high

Even after imposition of all feasible control measures, EPA anticipates a large degree of nonattainment. Without any change in the current NAAQS, EPA estimates that between 39 million and 57 million people will live in non-attainment areas for the foreseeable future. EPA expects an additional 14 million to 32 million people would live in non-attainment areas under the proposed revised standard.

EPA estimates that partial attainment of the standard will cost billions of dollars each year and impose *costs in excess of benefits* on Americans of between $1.1 billion and $6.2 billion each year. These net costs are over and above EPA's estimates of the annual net costs of partially complying with the existing standard, which are also considerable—EPA estimates the costs of partially meeting the current standard will exceed benefits by between $400 million and $2.2 billion per year.

The full costs of meeting this standard would be orders of magnitude higher than EPA's estimated costs of partial attainment. Our analysis suggests that the full cost of attaining the current standard will be between $22 billion and $53 billion per year. We estimate that the proposed standards will impose additional costs in the range of $54 billion to $328 billion per year (1990 dollars).

D. Recommendations

Based on our review and analysis of EPA's proposal, we offer the following recommendations.

1. EPA should not proceed with promulgation of the proposed standard

In light of EPA's science panel's conclusion that the proposed standard (level and number of exceedances) is not significantly more protective of public health than the alternatives examined, and the very real concern that implementation of this rule will actually harm public health and welfare, EPA should not proceed with its promulgation.

There may be adequate basis for changing the averaging time and form of the standard. However, as EPA's own analysis suggests that the current level of the standard already imposes social costs (both in terms of health and welfare) that exceed its benefits, EPA should not select a level and number of exceedances that is more stringent than the current standard.

2. More effective alternatives are available for addressing the potential ill effects of ozone

Non-regulatory approaches are available to achieve the public health benefits targeted by this rule. As CASAC recommended in its November 30, 1995 closure letter on the primary standard, public health advisories and other targeted approaches may be an effective alternative to standard setting.

> Because there is no apparent threshold for responses and no "bright line" in the risk assessment, a number of panel members recommended that an expanded air pollution warning system be initiated so that sensitive individuals can take appropriate "exposure avoidance" behavior. Since many areas of the country already have an infrastructure in place to designate "ozone action days" when voluntary emission reduction measures are put in place, this idea may be fairly easy to implement.

Furthermore, research and education are more likely to target what some public health experts regard as a more important factor behind the increasing incidence of asthma during a period in which ozone (and other pollutants) are declining—poverty and poor living conditions.

I. INTRODUCTION

Ozone is a gas that occurs naturally in the earth's troposphere and stratosphere. It is also created when sunlight reacts with nitrogen oxides (NO_X), and volatile organic compounds (VOCs). Tropospheric (ground-level) ozone is the primary constituent of urban smog.

Ozone levels are heavily influenced from year to year by meteorological conditions. EPA observes that the lowest national mean level of ozone was recorded in 1992, and the highest in 1988. After adjusting for meteorological effects, however, the year

to year trend shows a continued improvement in ozone concentrations of about 1 percent a year.[1]

Ozone is associated with respiratory problems, particularly in sensitive individuals. It is also credited with reducing the harmful effects of ultraviolet rays. Because it "may reasonably be anticipated to endanger public health and welfare," ozone has been identified under the Clean Air Act as a "criteria pollutant" The U.S. Environmental Protection Agency (EPA) must periodically review and, as necessary, revise its National Ambient Air Quality Standards (NAAQS) for criteria pollutants.

The CAA charges EPA with setting NAAQS that protect public health and welfare. In these comments,[2] we examine whether EPA's December 1996 proposed revision to the ozone NAAQS meets this mandate.

The rest of our comments are organized as follows.

Section II—Review of EPA's Proposal

We review EPA's statutory obligations, its interpretation of those obligations, and the factors EPA relied on in making its policy judgment regarding the appropriate standard to protect public health and welfare. This review suggests that because EPA bases its policy judgment on a narrow set of criteria, the resulting rule is likely to result in public health and welfare outcomes contrary to EPA's expressed intent.

Section III—Review of EPA's Regulatory Analysis

EPA's own regulatory analysis, summarized in the first part of this section, concludes that the costs of implementing the proposed standard will exceed the benefits. In the second part of this section, we identify major flaws in EPA's analysis and present revised estimates of the benefits and costs of the proposal based on our own analysis.

Appendix A—Uncertainties in EPA's Analysis

Due to the considerable uncertainty in the science associated with both ozone modeling and the health and welfare effects of different ozone levels, EPA's analysis necessarily involves numerous assumptions. This appendix reviews key uncertainties and assumptions.

Appendix B—Ozone's Impact on Ultraviolet Radiation

Ozone in the troposphere, like ozone in the stratosphere, has the beneficial effect of screening ultraviolet radiation, which is known to have various health and welfare effects including melanoma and non-melanoma skin cancer, cataracts, and crop and fishery damage. This appendix presents our analysis of the harmful public health and welfare impact that would be caused by the reduction in tropospheric ozone if this rule is implemented.

Appendix C—The Full Costs of Attainment

EPA's estimates reflect only the cost of partial attainment. In this appendix, we present our analysis of the full costs based (1) on assumptions EPA uses in its analysis, and (2) on our revisions to EPA's estimates.

Appendix D—Control Measures to Achieve Partial Attainment

This appendix reproduces EPA's Table C–1 from Appendix C of its Ozone NAAQS RIA. The table lists the control measures EPA expects to be used to achieve partial compliance with the current and proposed standards.

PREPARED STATEMENT OF CARL M. SHY, DEPARTMENT OF EPIDEMIOLOGY, SCHOOL OF PUBLIC HEALTH, UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL

SUBJECT: EPA'S PROPOSED AIR QUALITY STANDARD FOR PARTICULATE MATTER

My name is Carl Shy. I was a member of the Panel on Particulate Matter of EPA's Clean Air Science Advisory Committee (CASAC), and am currently a professor of epidemiology in the University of North Carolina School of Public Health. Over the past 2 years, I was an invited participant and discussant in EPA's workshops on the health effects of particulate matter, and, as a panel member of CASAC, a reviewer of the various drafts of EPA's criteria document for particulate matter and of the staff papers recommending an air quality standard for particulates.

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[1] U.S. EPA *National Air Quality and Emissions Trends Report, 1995.*

[2] These comments were prepared by Susan E. Dudley, Vice President and Director of Environmental Analysis at Economists Incorporated with support from the Regulatory Analysis Program at the Center for Study of Public Choice at George Mason University.

I make this statement to urge the members of the U.S. Senate to support EPA's proposed revision of the air quality standard for particulate matter, and more specifically to support the proposal to establish a new standard for fine particulates, i.e., for particles less than 2.5 micrometers diameter ($PM_{2.5}$). I agree with EPA's proposal that the $PM_{2.5}$ standard be established at a concentration of 15 micrograms per meter cubed, annual average.

I suggest that there are three compelling reasons for EPA to establish the air quality standard for $PM_{2.5}$ as proposed:

(1) There is ample evidence that there is a causal relationship between population exposure to fine particulates, at concentrations now existing in the air environment of many cities in the U.S., and excess mortality, hospital admissions, respiratory symptoms in adults and children, and decreases in lung function of children. I will expand on my reasons for stating that the evidence for a causal relationship is compelling.

(2) Accepting the causal relationship between air particulates and excess mortality and morbidity in the population, the health burden of exposure to ambient air particulates at current levels in the U.S. is unacceptable, consisting of thousands of excess deaths, hospital admissions and respiratory disease episodes. This large health burden can be addressed by a concerted program to lower the concentration of ambient air particulates in those cities that exceed the proposed annual standard for $PM_{2.5}$. This is an achievable goal, one that will have a major health benefit for a majority of the U.S. population.

(3) The Clean Air Act of 1970, amended several times, requires the Administrator of EPA to establish national ambient air quality standards at a level that avoids unacceptable risks and protects public health with a margin of safety. The $PM_{2.5}$ standard proposed by EPA, of 15 micrograms per cubic meter annual average, provides a minimally acceptable margin of safety against the mortality and morbidity risks noted above. A number of well conducted epidemiologic studies demonstrate an increase in mortality and morbidity when $PM_{2.5}$ concentrations begin to exceed the proposed standard of 15 micrograms per cubic meter. In some cases, this excess mortality and morbidity is observed even when $PM_{2.5}$ concentrations reach 16 micrograms per cubic meter, a level that is less than 10 percent above the proposed standard. In the future, we may well find that the 15 microgram per cubic meter standard is not adequate to protect public health, but the proposed standard will at least move our country in the right direction of greatly minimizing the currently unacceptable health burden.

Since the issue of the causal relationship between air particulates and mortality/morbidity of the population is crucial to the three points I am presenting in this statement, I would like to expand on my reasons for asserting that the causal relationship has been established to a degree sufficient to require EPA to propose the new standard for $PM_{2.5}$. The criteria for causality I will briefly discuss are the same at those used by the Surgeon General of the U.S. in the 1965 report on the adverse health effects of cigarette smoking. These criteria are widely accepted in the scientific community as reasonable guidelines for assessing causality in the matter of disease risks to populations. These criteria are:

Consistency: Many studies, numbering more than 30, have observed a significant and meaningful relationship between population exposure to air particulates and excess mortality and morbidity (the latter being increased hospital admissions, increased respiratory symptoms, and decrease lung function in children). Many of these studies have been carefully scrutinized for potential sources of error, for confounding by weather factors and season of year, for limitations in statistical methods, and for inadequacies of measurement methods. None of these potential problems were found to diminish the consistently observed relationships between adverse health effects and particulate exposures. EPA's Criteria Document for Particulate Matter, which the CASAC carefully reviewed and approved, provides extensive discussion of these issues and reaches the conclusion that the evidence is fully compatible with a causal interpretation. In comparison with the 1987 major revision of the air quality standard for particulates, when a PM_{10} standard was established, we now have a much larger body of evidence regarding adverse health effects of particulate air pollution.

Coherence: Among the more than 30 studies mentioned above, the same types of adverse health effects have been consistently observed. That is, the primary causes of excess deaths in mortality studies are deaths from heart and from lung diseases, and the primary causes of hospitalizations in morbidity studies are from diseases of the heart and lung. Other causes of death and hospital admissions do not show a consistent association with levels of air particulates. This agreement between the different types of studies strongly suggests a causal relationship, since the same disease endpoints are so consistently found when there is a common causal agent.

Exposure-Response Gradient: As levels of air particulates increased, there was a proportional increase in mortality or in morbidity in the above studies. The importance of finding an exposure-response gradient is that it becomes less and less likely that risk factors other than air pollution could explain the disease gradients. To do so, these other risk factors would also have to increase in nearly perfect step with changes in air quality, and there is no evidence that such risk factors exist, in spite of considerable effort to find them.

Cause Precedes Effect: The excess in mortality and morbidity consistently occurs either on the day of the elevated air particulate concentration or 1 to 2 days after the elevated concentration occurs. There is no evidence that excess mortality and morbidity precedes days with higher air particulates.

Strength of the Association: The relative increase in total mortality and morbidity associated with a 50 percent increase in air particulates is not large, being on the order of 5 to 10 percent above the mortality or morbidity observed on days with the lowest concentrations. From this point of view, the association between air particulates and mortality and morbidity is not nearly as strong as it is for tobacco smoking, excess alcohol consumption, or high fat diets. But, because a majority of the population is exposed on many days to air particulate concentrations above the proposed standard, the population burden of air particulate exposures is indeed large, with deaths and hospitalizations numbering in the several thousands during the course of 1 year. (Estimates range from 10,000 to 60,000 excess deaths alone, associated with days of higher air particulate levels in the U.S.)

Biological Plausibility: This criterion is satisfied when there is experimental evidence that air particulates can cause the type of human health responses that would lead to excess mortality and morbidity. We do not have firm evidence to satisfy this criterion, in part because, when animals or humans were experimentally exposed to particulates, the experimenters were unable to reproduce in the laboratory the complex mixture of particulates in the ambient atmosphere. Recently, these complex mixtures have been introduced into experimental studies, and the researchers report that they found physiological changes in the exposed animals that may indeed be precursors of mortality and morbidity. Furthermore, there is ample evidence from older studies that air pollution at considerably higher levels than now exist were causally related to excess mortality and morbidity in humans. Thus it is entirely reasonable that similar effects, but at lesser magnitude, are occurring at current elevated concentrations.

Specificity: This criterion requires that there be a unique relationship between exposure to the risk factor and the disease caused by this exposure, e.g., the nearly unique relationship that exists between asbestos exposure and mesothioloma of the lung. Very few causes of human disease manifest this unique relationship. Thus cigarettes cause lung cancer, but so do a number of chemicals that exist in the occupational environment. A lack of specificity does not argue against causality, nor does a lack of any one of the causal criteria negate the argument for causality, since each of these criteria are meant to serve as guidelines in making a judgment about a possible causal relationship.

Confounding by Other Air Pollutants: This is not one of the criteria addressed in the Surgeon General's report on cigarette smoking, but it is an issue frequently discussed at scientific meetings on the health effects of air pollution, and it was discussed in some depth at the CASAC meetings. The concern boils down to the question: can we conclude that fine particulates, as indexed by $PM_{2.5}$, are the causal agent responsible for the consistently observed excesses of mortality and morbidity? In my opinion, and in the opinion of other epidemiologists who are closely involved with research on the health effects of air pollution, the answer is, yes, it is reasonable to conclude that fine particulates, rather than any other regularly measured air pollutant, is our best measure of the causal agent. No other known air pollutant so consistently demonstrates an exposure-response relationship with mortality and morbidity across the many different studies reported in the literature. Although there are cities in which gaseous air pollutants, such as sulfur dioxide and ozone, are sometimes highly correlated with fine particle concentrations (and thus prevent drawing conclusions as to the most likely causal component in the air pollution mixture), there are enough studies in which the other pollutants were either present in such low concentrations that adverse health effects from these levels would be unlikely, or there were studies in which the correlation between particles and other air pollutants was sufficiently small to enable the investigators to distinguish between the effects of the different pollutants. Moreover, there is sound biological evidence that fine and ultrafine particles penetrate deeply into the lung and produce an inflammatory response, whereas gaseous air pollutants do not reach the lower portions of the lung except by becoming attached to fine particles.

There are many hazardous agents, often consisting of a complex of chemicals that cause significant human health risks, for which we do not know the precise causal component, but which we clearly know is part of the causal chain leading to harm. Several prominent examples of this can be cited, such as cigarette smoke and high fat diets. There are more than 200 chemicals in cigarette smoke, a number of which may cause lung cancer, chronic lung disease, and heart disease, but we do not know precisely which of these chemicals are actually the causal agent for these consequences. The relationship between fine particulates and excess mortality/morbidity is analogous to the smoking-health effects association. Fine particulates are the best single indicator of that component of the air pollution mixture consistently associated with excess mortality and morbidity. From this point of view, fine particulates are the causal agent, in the sense that they are a very useful and predictable marker for the complex of chemical and physical factors that are causing the unacceptable health consequences, just cigarettes are the causal agent for smoking-related deaths and disease. No other component of the air pollution mix is compatible with the diversity of findings on excess mortality and morbidity reported in the above studies.

For all of the above reasons, EPA has made the argument that a causal interpretation for fine particulates is a reasonable one. If we fail to take action on reducing population exposure to fine particulates, as proposed by EPA, we run the significant risk of continuing to allow thousands of excess deaths and diseases, with all of the associated societal costs, that could otherwise be prevented. It is not reasonable to wait until advances are made in scientific knowledge to prove *conclusively* that fine particulates are or are not the specific causal agent. We have sufficient evidence that fine particulate are a part of the causal chain, and that reduction in fine particulate levels is an efficient strategy to interrupt this chain.

Thank you for the opportunity to present this statement.

PREPARED REMARKS
PUBLIC HEARING - U.S. SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS-SUBCOMMITEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY AND NUCLEAR SAFETY
April 24, 1997

ISSUE: Risk Assessment Aspects of EPA's Proposed Revisions to the National Ambient Air Standard for Ozone (O_3)

SPEAKER: Morton Lippmann, Ph.D., Professor of Environmental Medicine

AFFILIATION: New York University Medical Center

RELEVANT PERSONAL BACKGROUND

1. Academic Peer-Reviewed Research Incorporated into O_3 and PM Criteria Documents, which has been supported by the National Institute of Environmental Health Science, the Electric Power Research Institute, the Environmental Protection Agency, and the Health Effects Institute. This includes:

   a) Respiratory tract deposition and clearance of airborne particles

   b) Controlled human and animal inhalation studies of physiological responses to acidic particles

   c) Field studies of population responses to air pollution exposures

   d) Development and evaluation of air sampling and monitoring techniques

2. Academic Air Pollution Research Study Advisement

   a) Member and Chair of External Advisory Comm., Harvard 6-Cities Study (1978-1987)

   b) Member of External Advisory Comm., Harvard - Health Canada - Multi-city Air Pollution Health Effects Study (1987-1991)

   c) Chair of External Advisory Comm., USC - CA Air Resources Board Study of Effects of Air Pollution on Children (1992-present)

   d) Chair of External Advisory Comm., Yale Univ.-Pierce Foundation Study of Health Effects of Kerosene Space Heater Effluents (1993-present)

3. Federal Agency Service on Committees Focussing on Inhalation Hazards

   a) Chair, Clean Air Scientific Advisory Committee (CASAC) (1983-1987)

   b) Member, CASAC Subcommittees on O_3 (1988-1997) and PM (1993-1997)

   c) Chair, Physical Effects Review Subcommittee of Clean Air Act Advisory Council (1994-1997)

   d) Chair, EPA Science Advisory Board (SAB) Review Committee for Risk Assessment for Environmental Tobacco Smoke (1991-1993)

e) Chair, SAB Review Committee for Risk Assessment for Dioxin and Related Compounds (1994-1997)

f) Chairman, Indoor Air and Total Human Exposure Advisory Committee, U.S. Environmental Protection Agency (EPA), 1987-1993

g) Co-Chair, 4th Task Force for Research Planning in Environmental Health Sciences, National Institute of Environmental Health Sciences (1992)

h) Chair, Board of Scientific Counselors, National Institute for Occupational Safety and Health (1990-1992)

4. International Service on Air Pollution Issues

a) Chair of Working Group on Acute Health Consequences of Winter-type and Summer-type Smog Episodes. World Health Organization-European Region (1990-1991)

b) Member of Working Groups on Air Quality Guidelines. World Health Organization-European Region (1985-1987 and 1994-1997)

5. National Academy of Science Committees

a) Member, Committee on Measurement and Control of Respirable Dust in Mines, National Materials Advisory Board, National Research Council, 1978-1979

b) Member, Committee on Toxicity Data Elements, Board of Toxicology and Environmental Health Hazards, National Research Council, 1980-1983

c) Member, Committee on Methods for the In Vivo Toxicity Testing of Complex Mixtures from the Environment, Board on Toxicology and Environmental Health Hazards, National Research Council, 1985-1987

d) Member, Committee on Research and Peer Review in EPA, Commission on Geosciences, Environment, and Resources, National Research Council, 1994-1997

OUTLINE OF REMARKS THAT FOLLOW

THE SCIENTIFIC BASIS FOR EPA'S RISK ASSESSMENT FOR OZONE

Controlled Human Exposure Studies
Field Studies of Responses to O_3 in Ambient Air
Epidemiological Studies of Large Populations
EPA's Use of the Available Peer-Reviewed Literature
Role of Ozone Formation in Ambient Air on the Health Effects of Fine Particulate Matter

RESEARCH NEEDS FOR FUTURE REVISION OF THE OZONE NAAQS

MY RECOMMENDATIONS TO CONGRESS

THE SCIENTIFIC BASIS FOR EPA'S RISK ASSESSMENT FOR OZONE (O_3)

Controlled Human Exposure Studies

The EPA's own Clinical Studies Laboratory in Chapel Hill, NC, has, over the past fifteen years, conducted an extensive and highly meritorious series of studies involving the controlled inhalation exposures of human volunteers to O_3 during mild to heavy exercise over time periods ranging from 2 to 8 hours; some studies involved repetitive daily exposures. Most of the volunteer subjects have been healthy young adults, but a few studies have also examined responses in healthy children and adults with chronic respiratory diseases. The studies initially focused on characterizing the extent and distribution of transient changes in respiratory function and symptoms, but most recent studies have also made measurements of other responses more closely associated with adversity, such as increases in the concentrations of inflammatory cells and mediators in the lung airways and increases in the permeability of the airway walls. These studies, involving lung lavage analyses, have shown that inflammation of the lungs is more persistent than increased airflow resistance and reduced lung volumes. Other controlled human O_3 exposure studies, performed by other investigators, have produced consistent findings. Thus, the O_3 Criteria Document (CD) and Staff Paper (SP) could draw on a rich data base on human responsiveness to short-term exposures of people engaged in exercise to O_3 added to a purified air stream. The proposed 8-hr NAAQS of 0.08 ppm is based largely on this data base.

Field Studies of Responses to O_3 in Ambient Air

The O_3 CD and SP also cited and discussed a series of field studies in which children in summer camps and adults engaged in outdoor recreational activities had sequential daily measurements of lung function. They showed that lung function was decreased in proportion to the O_3 concentration in the ambient air. Most of these studies were performed under my direction with contractual or cooperative agreement support from EPA.

The studies of children and others engaged in outdoor recreational programs, and studies of workers exposed outdoors were not, in my view, given sufficient attention by EPA, as I have previously noted in my review comments to EPA. The EPA chose not to rely on them as much as I believe they should have because of acknowledged uncertainties about the influence of confounding factors always present in such studies. Some of the uncertainties raised about these studies concern whether the camp studies are able to eliminate other environmental factors and air irritants such as weather, dust, pollen that may mask ozone's effect. In our analyses, temperature and humidity were taken into account analytically, and shown not to be important confounders. The studies were performed during periods when allergen exposures were minimal. Exercise was taken into account in general terms, but precise measures were not a practical option. In our own (NYU) studies, we chose camps with relatively vigorous activity programs in order to increase the probability of detecting effects that were occurring.

Another important consideration is that the chamber studies were done under conditions that do not reflect those for the "sensitive populations" or even those that we experience daily. While the recent chamber studies used exercise levels that are generally considered to be well above normal (ventilation rates of 50-68 liters/minute), they were not necessarily extreme. In a study that my group did on adults engaged in regular outdoor exercise (brisk lunch hour walks or jogging in Tuxedo, NY) the volunteer subjects self-selected their exercise level and duration (average ~ 30 minutes). Ten of thirty subjects chose minute ventilations above 100 liters, and ten others were in the range of 60-100 liters. For those with rates between 60 and 100 liters/min, their response to O_3 in ambient air after 1/2 hour were

about twice those of the subjects exercising at comparable rates in chambers for alternate 15 minute periods over a span of two hours. Thus, the results of the chamber studies underpredict responses in real life (See: Spektor, D.M., et al., Am. Rev. Respir. Dis. 138: 821-828, 1988). One possible reason for this greater response is that ozone in ambient air is always part of a mixture. Since the other parts of the mixture are not correlatable with the responses characteristic of ozone, then the ozone NAAQS should recognize that the mixture is generally more toxic than ozone alone and that the NAAQS needs to be more restrictive than one that the results of the controlled exposure studies alone would support. In summary, the weaknesses of the chamber studies lies in: 1) small populations; 2) single exposures, which does not correspond to the ambient exposures which people have on a daily basis; 3) use of O_3 alone in purified air, which eliminates synergism with other pollutants normally present with O_3 in ambient air.

Epidemiological Studies of Large Populations

The O_3 Criteria Document (CD) thoroughly summarizes the myriad well-documented health effects that occur in both healthy people and asthmatics as a result of exposure to O_3 in ambient air, including pulmonary function deficits, lung inflammation, increased lung permeability and responses to allergic stimuli, altered lung clearance of inhaled particles and increased infectivity of disease agents, increased rates of usage of clinics, emergency rooms and hospital beds for respiratory diseases, and lost-time from work and school. It also discussed equivocal evidence for excess daily mortality on peak O_3 days. More recent positive findings in peer-reviewed papers on studies in London, England; Rotterdam and Amsterdam in the Netherlands; and Brishane, Australia increase the likelihood that O_3 exposure does indeed cause excess mortality.

The O_3 Staff Paper evaluated data from a NYU study of excess daily hospital admissions for asthma in New York City (of which I was a co-author) as a key example of an adverse health effect of O_3 exposure. The tabular summary of this analysis in the Staff Paper indicated that the number of asthma admissions attributable to O_3 was a relatively small fraction of the total number of year-round asthma admissions. This is certainly true, but ozone is a summertime phenomenon, when other causes of asthma exacerbation are at their lowest levels, and the year-round denominator is therefore not the appropriate divisor. Asthma is a serious and growing problem to millions of people and the health-care community. There is no good evidence that O_3 causes new cases of asthma, but clear evidence that it exacerbates the condition in the numerous people who suffer from asthma.

What is not evident from the analyses in the Staff Paper is that the hospital admissions for asthma is not the only, or even the most serious of the adverse impacts of O_3 on human health. Rather, it serves as the "lamppost" under which the evidence was most readily visible. My colleague at NYU, Dr. George D. Thurston, has prepared a visual aid, based on his research and research by others, to more fully illustrate the range and magnitude of the health effects attributable to O_3 in New York City in each year that could be avoided by implementation of the proposed revision of the O_3 NAAQS. It can be seen that the estimate of 265 hospital admissions for asthma is near the tip of the "iceberg", along with 240 other hospital admissions (for other pulmonary diseases), 75 cardiopulmonary deaths, and 3,500 emergency room visits. It also can be seen that the total impact extends to millions of excess symptoms and disease incidences.

Pyramid of New York City, NY Annual Adverse Ozone Impacts Avoided By The Implementation of The Proposed New Standard (vs. "As Is")*

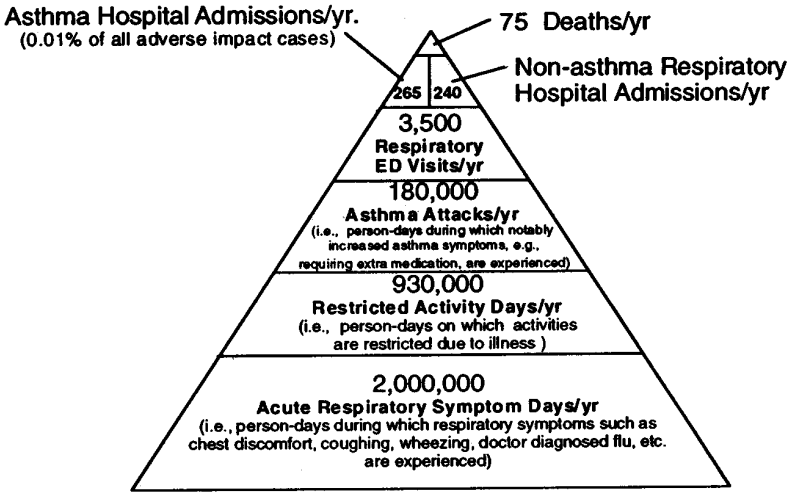

*Figure section sizes not drawn to scale.

Most of the epidemiological scientific studies that are relevant to the setting of NAAQS were not designed or performed with that specific application in mind. EPA-supported epidemiological research has been far too limited in scope, nature and extent to provide a data base for standard setting. The fact is that, because of limited research resources, constantly shifting research priorities, and a long-term policy choice to have only a minimal in-house capability for epidemiologic research, the quite limited amount of research most relevant to the chronic health effects of O_3 has been performed by academic investigators with resources provided by others such as, for example, the National Institutes of Health, the Health Effects Institute, the Electric Power Research Institute, Health-Canada, and the California Air Resources Board. One result of this welter of diverse sponsorship, and therefore of research goals, is a wealth of information that is, unfortunately, composed of bits and pieces of the overall puzzle. It requires careful sifting to separate those elements of sufficient quality to inform the issues, as well as mature judgment to fit the pieces into an informative framework sturdy enough for summary judgments.

Role of Ozone Formation in Ambient Air on the Health Effects of Fine Particulate Matter

The main reason for linkage between the O_3 and PM NAAQS lies in their future implementation rather than in setting their NAAQS. A large part of $PM_{2.5}$ is created in the same photochemical reaction sequence that leads to O_3 formation. Furthermore, a major part of

the rest of the $PM_{2.5}$ is acidic aerosol whose formation depends in major part on the photochemical oxidants role in oxidizing SO_2 and NO_x vapors to form acidic fine particles. Thus, $PM_{2.5}$ cannot be effectively controlled without controlling the formation of ozone, and tighter restrictions on ambient O_3 concentrations will result in lower exposures to $PM_{2.5}$ and the health effects caused by $PM_{2.5}$ exposures.

EPA's Use of the Available Peer-Reviewed Literature

Despite some critical remarks that I have made above, I want to acknowledge the incredibly careful sifting of the evidence performed by EPA's National Center for Environmental Assessment (NCEA). The oversight and prodding of CASAC has helped to ensure that essentially all of the relevant peer-reviewed science was examined in detail and appropriately summarized and interpreted in the final draft of the Criteria Document (CD). The corresponding public review sessions by CASAC of the Staff Paper (SP) drafts prepared by EPA's Office of Air Quality Planning and Standards (OAQPS) also ensured that the final draft of that document provided appropriate summary judgements on the scientific aspects of those items in the CD most relevant to the setting of the NAAQS. These items include the effects of concern, populations at special risk, optimal form and averaging times for the NAAQS, and the most likely residual effects associated with exposures to be expected across a possible range of concentration limits. This process thus provided the Administrator with the best possible basis for the difficult NAAQS decisions that are required to be made periodically under mandate of the CAA amendments of 1977.

There has never been a decision point where the Staff, the CASAC, or the Administrator has been satisfied with the available scientific data base, despite the ever increasing size and sophistication of the available data in successive review rounds. Our current knowledge always leads to new questions and concerns. More so than in the past, we are debating whether the measurable effects are sufficiently adverse to warrant public health protection rather than identifying whether measurable effects are occurring. However, the Administrator will still have, and will, I suspect, always have to make a judgment as to the margin of safety to apply in the absence of definitive knowledge.

Despite all of their thoroughly discussed and acknowledged limitations, both the PM and O_3 literature reviews and analyses in the CDs and SPs are the best prepared and most comprehensive ever available to an Administrator as a basis for NAAQS decisions. In fact, the favorable contrast of these CDs and SPs with those from prior rounds of NAAQS is really remarkable.

FUTURE RESEARCH NEEDS

While the present research base provides sound support for the current EPA NAAQS proposals, more can be learned that can aid in the most efficacious implementation of the new standards during the next decade, as well as to provide a basis for still better focussed NAAQS in the next round.

Ozone Health Effects

In terms of research needs for O_3, the following are my personal recommendations for health effects research based upon my own research experience and service on CASAC panels.

The most pressing need is for research on the cumulative effects of O_3 on lung development in children and on accelerated aging of lung structures that may shorten life-span in adults. We have a lot of data on transient functional effects of O_3 from controlled human

exposure studies. Such studies can provide information on chronic pollutant effects only to the extent that prior exposures affect the transient response to single-exposure challenges. Most of the limited data we have on the effects of chronic O_3 exposures on humans come from epidemiological studies. Epidemiological studies can establish chronic health effects of long-term O_3 exposure in relevant populations, and offer the possibility that the analyses can show the influence of other environmental factors on responses to O_3 exposure. We know, for O_3, for chronic exposures of rats and monkeys, that cumulative changes in lung structure occur, and can these can be described as excess stiffening and/or premature aging. Some lung autopsy research of sudden accident victims in Los Angeles County suggests that similar effects are occurring in humans.

We also need more controlled exposure studies focussed on the mechanisms and patterns of response to inhaled O_3 and of the influence of other pollutants and stresses on these responses. Studies of the transient responses to acute exposures can establish the interspecies differences in response among animal species, and between them and humans similarly exposed. Animals are needed for studies of responses that require highly invasive procedures or serial sacrifice to gain information that cannot be obtained from studies on human volunteers. Finally, we should use long-term exposure protocols in animals to study cumulative responses and the pathogenesis of chronic disease in animals. Studies on animals can examine the presence and basis for variations in response that are related to age, sex, species, strain, genetic markers, nutrition, the presence of other pollutants, etc.

Research is also needed to establish the interrelationships between small transient functional decrements, which may not in themselves be adverse effects, and changes in symptoms, performance, reactivity, permeability, and counts of inflammatory cells. The latter may be closely associated with adversity in themselves, or in the accumulation or progression of chronic lung damage.

Chronic human exposures to ambient air appear to produce a functional adaptation that persists for at least a few months after the end of the O_3 season but dissipates by the following spring. Several population-based studies of lung function have indicated an accelerated aging of the lung associated with living in communities with persistently elevated ambient O_3. The plausibility of accelerated aging of the human lung from chronic O_3 exposure is greatly enhanced by the results of chronic animal exposure studies in rats and monkeys. There is little reason to expect humans to be less sensitive. Humans have a greater dosage delivered to the respiratory acinus than do rats for the same exposures. Also, the rat and monkey exposures were to confined animals with little opportunity for heavy exercise. Thus, humans who are active outdoors during the warmer months may have greater effective O_3 exposures than the test animals. Finally, humans are exposed to O_3 in ambient mixtures. The potentiation of the characteristic O_3 responses by other ambient air constituents seen in short-term exposure studies in humans and animals may also contribute toward the accumulation of chronic lung damage from long-term exposures to ambient air containing O_3.

In summary, the lack of a more definitive data base on the chronic effects of ambient O_3 exposures on humans is a serious failing that must be addressed with a long-term research program.

MY RECOMMENDATIONS TO CONGRESS ON OZONE

1. Recognize that EPA Administrator has made a prudent public health judgment in her O_3 NAAQS selection. The current NAAQS of a 1-hr max of 120 ppb, not be exceeded more than 4 times in 3 yrs, is equivalent to an 8-hr max of 90 ppb based on the 3rd highest 8-hr value in a year. Thus, the proposed 8-hr max of 80 ppb is only a modest O_3 NAAQS reduction. By contrast, the Air Quality Guideline for O_3 of the World Health

Organization-European Region (WHO-EURO), adopted late in 1996 is an 8-hr maximum of 60 ppb. In my view, the 8 hr-80 ppb proposal is a prudent step in the right direction at this time and recognizes that any lower limit is probably not achievable without draconian controls. The major advance is the shift to an 8-hr averaging time, providing a much sounder basis for evaluating the public health risk from community exposures.

2. Recognize that while the costs of the research recommended above are substantial, they are quite small in relation to the control costs that can be more effectively targeted and reduced through the knowledge gained, and also small in comparison to the health benefits resulting from exposure reductions to O_3 and $PM_{2.5}$ resulting from the implementation of the revised O_3 NAAQS.

RESPONSES BY MORTON LIPPMANN TO QUESTIONS FROM SENATOR LIEBERMAN

Question 1. Some have contended that the effects of ozone are not that serious and that a temporary loss in lung function of 20 to 30 percent is not really a health effect. Do you think this is true? How serious is a loss of 20 to 30 percent of lung function in asthmatics and other sensitive populations—the groups the Clean Air Act is intended to protect?

Response. Many of the effects of ozone are quite serious. On page 5 of my prepared remarks, I showed the pyramid of effects attributed to ozone in New York City. These range from the most serious, i.e., premature mortality, and hospital admissions for asthma and for other respiratory diseases. Somewhat less serious, but more prevalent effects include the asthma attacks and restricted activity days. Less serious effects include symptoms and modest changes in lung function (<20%) in healthy individuals. The diagram of effects did not include the respiratory function responses, which vary in seriousness between healthy individuals and those with chronic lung disease. In an individual with asthma or chronic obstructive pulmonary disease, a 20% decline in lung function can be quite serious, and lead directly to the need for increased medication usage, physician or clinic visits, and/or restricted activities.

Question 2. An issue associated with the ozone standard is who responds and how much. Dr. Chilton used a figure (from p. 31—Ozone Staff Paper) in his testimony that shows relatively small lung function declines for varying ozone and exercise levels. Is this the most appropriate way to illustrate the typical distribution of lung function declines in ozone chamber studies?

Response. The figure illustrating declines in lung function in relation to ozone concentration and level of exercise does not represent several important aspects of our current knowledge. First, it is based on two-hour exposures, and therefore does not depict what happens during the chamber exposures lasting 6.6 hours. The great increase in average response during successive hours is illustrated on p. 32. Second, it only shows the average response. It is well known that some individuals have essentially no response, while a significant portion of the population have much greater than average responses. These people must breathe the ambient air and need to be protected.

Question 3. One of Ms. Dudley's arguments for not setting a tougher ozone standard is that while air pollution is dropping, the incidence of respiratory disease is increasing. If this is true, the argument might be, then air pollution is not causing respiratory disease. What is your response to this?

Response. The incidence of asthma has indeed been rising. There is one recent report (Abbey, D.E. Presentation at 1997 Annual Conference of the Health Effects Institute) that indicates asthma incidence among Seventh Day Adventists in California was significantly associated with ozone. However, even if ozone was not associated with asthma incidence (new cases), it is well known that ozone is highly correlated with the frequency of asthma exacerbations. Thus, more asthma prevalence (from whatever causes) leads to more ozone exacerbations.

Question 4. I think you've been clear in your testimony before this Committee that you believe the Administrator made a prudent public health decision with respect to both the particulate matter and ozone standards. I also think you have been clear that you do not support substituting a research program for the proposed particulate matter standard. Is this correct?

Response. Yes. I see no good reason to delay the promulgation of the ozone and fine particle standards proposed by the EPA Administrator in November 1996. It is true that currently mandated reductions in SO_2, NO_X and hydrocarbons will bring down ozone and fine particle concentrations in future years, but are not likely to be optimally targeted to meet health protection goals based on 8 hr ozone and $PM_{2.5}$ targets. It is only by having better targets that our health protection goals can be efficiently structured. At the same time, a minimum of $\$50 \times 10^6$ per year for targeted NAAQS research represents a wise investment decision for the creation of a much firmer data base for the difficult NAAQS decisions that will be needed early in the next decade.

-Panel I-

THE PROPOSED NAAQS FOR PM AND OZONE

Testimony of

Alan J. Krupnick, Ph.D.
Senior Fellow
Resources for the Future

before the
Subcommittee on Clean Air, Wetlands,
Private Property and Nuclear Safety
Committee on Environment and Public Works
United States Senate
Washington, DC

Thursday, April 24, 1997

Mr. Chairman and distinguished committee members. Thank you for inviting me to testify on the proposed National Ambient Air Quality Standards for ozone and particulates (PM). I am pleased to provide you with my ideas and judgments on the issues, from my perspective as a professional environmental economist, based on fourteen years of experience at Resources for the Future (RFF), many of them spent on issues associated with the Clean Air Act, with the epidemiology of air pollution, and with cost-benefit analysis of air pollution control programs. RFF is an independent, non-partisan research and educational organization concerning itself with environmental and natural resource issues. In addition, I have recently served as a senior economist on the Council of Economic Advisors (CEA), with primary responsibility for the environmental and natural resource portfolio. While at CEA I worked on a number of Clean Air Act issues, including EPA's preliminary planning for analyses required to re-promulgate the NAAQS for ozone. Also, I currently co-chair (with OAQPS Director John Seitz) the Clean Air Advisory Committee's subcommittee on Ozone, Particulate Matter, and Regional Haze Implementation Programs. I want to emphasize that the views I present today are entirely my own.

In the testimony that follows, I will first speak directly to the proposed standards for PM and ozone. Next I will discuss the results of benefit-cost analyses that have looked at the impact of the proposed regulations. Irrespective of the criterion in Title I for setting the NAAQS, the public deserves to know what they will have to give up and what they will get from the proposed changes in the standards. Thus, it is fully appropriate to discuss costs and benefits. Indeed, one could argue that after the science has "spoken" and the Administrator then must make a policy judgment, this judgment can be informed with information from cost-benefit analyses without running afoul of the Clean Air Act. Finally, I will detail my specific recommendation to Congress: that cost-benefit analysis be given an explicit role to play in the standard-setting process. Appendix A provides a brief discussion of the nature of cost-benefit analysis from the point of view of a practitioner.

I. The Proposed NAAQS for Fine Particles

A. Health Effects

I believe that the scientific record supporting a fine particle standard is more than adequate, judged from the perspective of information underlying previous NAAQS rulemaking efforts. Of course there are major uncertainties about the type and size of particles that are the most potent, as well as about the magnitude of their effects. There are always uncertainties about pollution effects on health. Here the uncertainties may be larger than for other pollutants, particularly given the lack of an identified toxicological mechanism. Nevertheless, I am convinced that on the basis of the epidemiology I have seen the U.S. needs to begin focusing its attention on fine particles as a potentially major health risk and that the Administrator is being prudent to issue a fine particle standard.

In particular, I take issue with the charge that the science supporting a fine particle standard is "junk science." The statistical correlation between elevated mortality rates and particulate levels and between a great variety of morbidity measures and particulates has been observed by many researchers studying populations in various parts of the country. Not only are statistically significant associations found regularly, the magnitude of the effect observed is remarkably consistent from one study to the next, from one region to the next, and across various health endpoints predicted from a change in PM2.5 (e.g., estimates of reduced hospital days are lower than estimates of reduced symptom-days).

As to those who would wait until uncertainties are resolved, I say that the best way to gain a better understanding of this pollutant and its consequences is to issue a fine particle standard now.

B. Recommendations

1. In its final rule, EPA should require a fine particle standard set at the upper end of the range proposed in the Staff Paper and the *Federal Register*, (FR) i.e., 20 ug/m3 annual average/65 ug/m3 24-hour average.

While I believe that the scientific record supporting a fine particle standard is more than adequate, at the same time I believe that the Administrator has not articulated a coherent set of criteria upon which to base her policy judgment that the appropriate standard is the one she proposed (15ug/m3 annual average and 50 ug/m3 24-hour average). Without a threshold (or even a "knee in the curve" of the concentration-response functions) to anchor her judgment, Section 109 leaves her without any criterion to base her decision. And the obvious criterion -- balancing the gain with the pain -- is denied to her. She provides two unsatisfactory and inconsistent rationales: "not too tight and not too loose" and "protect our children." The first rationale is unsatisfactory given that particulates appear to have major effects on health down to background levels and is inconsistent with the second rationale. The fact is that pollution levels have been going down even as reported numbers of asthmatics are going up, so pollution cannot be the cause. Ironically, had the Administrator been able to consider the costs and benefits of alternative standards, the analysis could *perhaps* (see below) have been used to bolster her claim that a stringent standard is warranted.

If costs and benefits are not to be factors in the Administrator's policy judgment -- in our view they are essential factors -- then a second-best rationale should be the need to balance concerns about protecting public health with the uncertainties in the science that could lead to regulating the wrong pollutants, which, in some cases, could make the problem worse. An annual fine particle standard set at 20 ug/m3 meets this criteria. Such a standard will, for most parts of the country, result in a small tightening of the PM10 standard,[1] signaling the greater health protection needed against this pollutant class, while

[1] See JAWMA, Eldred, et al., pp. 204-211 **47**(2), showing the average ratio of PM 2.5 to PM10 is about 0.5.

also spurring the necessary effort to install PM-fine monitors, push ahead on research, and plan to reduce PM2.5 precursors.

2. EPA could be required, if there is a finding that the PM2.5 standard is in error and that other particle sizes or components of PM2.5 would be more appropriate to regulate, to trigger a fast-track SIP modification process as well as a new rulemaking proceeding to account for this new information.

Because of uncertainties about the mechanism by which particles affect health, the size and composition of the most potent fine particles, and the areas of the country that may be in violation, the agency also needs to give some assurance to the public that if this standard is later shown to be counterproductive -- in the sense of regulating the wrong particles -- it will swiftly and cost-effectively move to correct the situation. I therefore propose that Congress bind EPA (i) to make an immediate and major research effort to resolve the above uncertainties, (ii) to develop a SIP modification process that would eliminate counterproductive aspects of state SIPs in line with future research results, and (iii) to develop a fast track NAAQS-setting process, with the goal of setting a new PM NAAQS if new research casts doubt on the fine particle decision.

An alternative way of minimizing the regret of setting the wrong standards is to focus on the segment of fine particles that is most likely to be affecting health and add other components as the evidence comes in (through abbreviated NAAQS standard-setting processes). In my view, the evidence for sulfates is the strongest of any of the specific particle types. Indeed, discussions about the integration of ozone and PM rulemaking focus almost entirely on NOx, even though there is no health effect evidence linking fine particle nitrates (formed from NOx) to health effects. Therefore, EPA could set a relatively loose sulfate standard now rather than a PM2.5 standard and then amend this standard through subsequent rulemakings if other particles are shown to be implicated.

3. Congress should fund PM-fine monitoring and health-based research to understand the mechanism by which fine particles appear to affect morbidity and mortality risks, and the size and composition of fine particles that are the most potent.

4. If EPA decides to promulgate a fine particle standard, there is a strong scientific and policy rationale for setting this standard differently for the east and west. EPA could propose a PM2.5 standard for the eastern U.S. and a PM1.0 standard for the West. Needless to say, this suggestion would clearly stretch the Clean Air Act.

If EPA goes forward with a fine particle standard, I recommend, if possible under the Clean Air Act, that EPA set different, but equivalently stringent standards in the eastern and western U.S. Specifically, EPA should set a PM2.5 standard for the Eastern U.S., where this particle size appears to be a reasonable proxy for anthropogenic emissions.

Because PM2.5 particles in the West evidence a much larger share of (non-anthropogenic) crustal material than in the East, to focus on the anthropogenic emissions, EPA should set a PM1.0 standard.

II. The Proposed NAAQS for Ozone

A. The Health Science

The clinical and epidemiological studies establish a reasonable basis for ozone affecting health. The clinical studies of the effect of ozone on symptoms and lung function clearly show effects at lower concentrations but longer (8-hour) exposure times than for the current one-hour standard. Nevertheless, the epidemiological studies find very small effects of ozone on health, particularly compared to PM exposures. EPA acknowledges that asthma- and hospital admission-effects are small, for instance (FR, November 30, 1996). EPA also admits that responses at 0.08 ppm are small or mild on average but says some individuals have severe or long duration reactions. The text does not provide any information on the fraction experiencing the more severe effects, nor is there any description of what "really react" means. No evidence is offered to support the assertion that "repeated inflammatory responses" are necessarily adverse. Indeed, in EPA's own risk assessment it appears that EPA defines "adverse" to mean "lung function decrements occurring once per year." This is a stretch even for the American Thoracic Society.

B. Recommendations on the Ozone Standard

1. EPA should make the standard more relevant to the science by defining an 8-hour standard and more robust through offering a concentration-based standard.

I am particularly supportive of the change to the 8-hour standard because, through the invalidation of subpart 2 of part D of title I of the Clean Air Act, "Additional Provisions for Ozone Nonattainment Areas," it opens the door to significant reform of the implementation of the ozone standard.

2. In its final rule, EPA should require an 8-hr, concentration-based, 3 year-average standard that is equivalent in stringency to the current one-hour standard.

In proposing this ozone standard, EPA has moved beyond the health science into, as stated in the Federal Register notice (FR), "policy judgments." Importantly, these are not just judgments about the appropriate margin of safety, which was always a policy judgment, but include judgments about the appropriate level of the standard that protects public health. This extension of judgment is appropriate given the emerging consensus that for ozone there is not a threshold exposure below which no health effects are observed. Unfortunately, the Administrator has not articulated a coherent set of criteria

upon which to base policy judgments. The rationale appears to be "not too tight and not too loose."

Without a threshold to anchor her proposed standard, the Administrator is looking for a "knee in the curve" of the effects of ozone on health and draws on an EPA risk assessment for this. Unfortunately, this analysis is significantly flawed. This risk assessment (which finds that the equivalent 8-hour standard (in terms of health risk) to the current standard is 0.08 5AX) is based on a study of nine cities. This study appears to show that health benefits of a tighter standard appear to fall off below 0.08 ppm. However, EPA's risk assessment fails to account for the additional areas that would violate the standard if a tighter standard were issued. If such an analysis were performed it would likely show that every proposed standard that is tighter than 0.09 3AX will reduce total population risk relative to attainment of the current standard, rather than only after the standard is tightened to at least 0.08 3AX,[2] as is now asserted. This analysis would undercut the Administrator's assertion that a 0.08 5AX standard is equally stringent (in terms of health protection) to the current standard and that therefore, EPA needs to tighten the current standard to 0.08 3AX.

There are other problems with EPA's findings and analysis. There is little evidence that the differences in risk between the different forms of the standard are statistically significant, based on the data in the risk assessment Furthermore, it appears that distinctions between the proposed policy options, while weak for the less-significant endpoints such as the fraction of the population experiencing greater than a 15% (reversible) lung function decrement, are even weaker as the endpoint becomes more severe, even among the endpoints considered in the EPA's original risk assessment, which also included moderate to severe pain on deep inhalation. For example, with respect to the endpoint "hospital admissions among people with asthma," according to EPA's estimates, only 0.6% of total respiratory admissions for asthmatics due to all causes will be eliminated by reducing ozone to the level of the most stringent form of the standard under consideration (0.08 ppm 1 ex). No uncertainty bounds are given on this estimate.

The endpoint considered in the Ozone Staff Paper that was arguably the most severe, moderate to severe cough, was omitted from analytical consideration altogether in the risk assessment, presumably because the effects levels were so low and so little distinction between the proposed standards was evident for this endpoint. This information should not be buried or left out of the report, however, as it provides important evidence suggesting that for this serious and readily observable endpoint, the various proposals under consideration are unlikely to provide better protection than the current standard.

In point of law, the Administrator cannot defend a standard causing *any adverse* health effects. By that logic and given the historical interpretation of "adverse" as virtually any observable effect, she should set the standard at 0.07 or *below*. Said another way, the EPA cannot assert that there will be no health effects at its proposed standard, nor that

[2]This means a standard of 0.08 ppm with the third highest 8-hour reading in each of three years averaged. If this value is greater than 0.084 ppm, the area is in violation.

there is really anything special about the chosen point in the science-supported range relative to any other point. As the Administrator is obviously unwilling to set a standard at 0.07 ppm, she is left with little rationale for her choice of the 0.08 3AX standard.

Rather, stringency should be defined in terms of a *national* risk measure, such as total number of counties in nonattainment, total population in nonattainment areas, or total population-ppm-days above the standard. Some evidence suggests that this could be either a 0.09 3AX standard or a 0.08 standard with 7AX or more.

There are several additional reasons for not tightening the stringency of the standard. First, the Clean Air Science Advisory Committee (CASAC) has stated that health is protected adequately at any level from the 8-hr equivalent of the current standard on down. Why should the country incur additional costs for extra protection. Second, there is strong evidence, provided in EPA's own Regulatory Impact Assessment and elsewhere, that at this time the costs of further reductions will exceed the benefits, and that therefore, society's scarce resources will be wasted by putting additional billions of dollars into additional ozone reductions. Taken together, and without disputing the well-justified move to an 8-hr, concentration-based standard, these facts argue for a standard changed in form but not stringency.

3. EPA should acknowledge the interplay between the choice of the number of exceedances and the level of the standard.

Stringency is defined by both the level of the standard and the number of daily exceedances permitted, in the sense that the stringency of a given standard with many exceedances can be equivalently reproduced (in terms of health effects) by allowing fewer exceedances of a higher level standard. EPA discusses this issue as if this equivalency did not exist. An example is the comment in II. C.3. of the FR that the choice of a level of the standard between 0.08 ppm and 0.09 ppm is more important than the choice about the number of exceedances permitted. If the FR used the example of a choice between 0.081 to 0.082 ppm, the conclusion would be that the choice of exceedances is more important. Arguing EPA's way, if reducing the number of exceedances has so little beneficial effect, why not propose a lot of them and save the country additional costs?

In fact, EPA's logic for its choice of a 3 exceedance standard is unsatisfactory. Basically, the logic is that it is between 1 and 5. But, who set 5 as the appropriate upper end of the range? Why not 10? Of course, there is a limit to this sort of thing. But, EPA provides no basis for choosing a number. Indeed, EPA has a tough task because the Clean Air Act standard setting criteria does not provide the Administrator criteria for deciding on exceedances. After all, the current "one exceedance permitted in three years" standard was an arbitrary decision. Using two, five or ten exceedances permitted would be equally, but not more, arbitrary. Essentially this is a policy call.

This call has vast importance to the states, as tens or even hundreds of fewer counties can be found in compliance by a proposal that the standard permit one or two additional exceedances.

4. EPA should incorporate in its policy judgments, its risk assessment, and its Regulatory Impact Assessment, the effects of increased UV-B radiation on health.

Ground level, like stratospheric ozone, has been linked with reductions in exposure to UV-B radiation, which causes skin cancer. These health effects, while uncertain, are no less uncertain than some of the health effects attributable to ozone already incorporated in the risk assessment and the RIA.

III. Costs and Benefits of Meeting the Ozone and PM Standards

Costs.

By EPA's own analyses (in its November, 1996 Regulatory Impact Analyses (RIAs) for Ozone and PM), the cost of going *part way* to meeting the ozone standard will be $2.6 billion and the cost of going *part way* to meeting the fine particle standard will be $6 billion, annually. These sums do not come close to bringing the country into attainment. For ozone, Chicago needs a 44% reduction in volatile organic compounds (VOCs) to go from the 2007 baseline ozone concentration to a 0.08 1AX standard but gets 14%; Baltimore/Washington needs 66% VOC reductions but gets 14%; New York needs 79% but gets 16%; Los Angeles needs 90%, but gets 9%. For PM, the northeast U.S. is estimated to need an 86% reduction in PM2.5 concentrations from baseline, but EPA can only find and cost out technologies to deliver 16% of what the region needs. The same types of estimates apply to other regions.

PM 2.5 Reductions needed in 2007		
Region	% reduction achievable from baseline	% reduction needed from baseline to attain proposed standard
NE	16	86
RM	23	87
SC	10	99
SE	21	99
NW	3	89
W	2	93
CA	4	78

EPA's cost estimates for ozone are far lower than those from a *very credible* study by funded by the American Petroleum Institute (Sierra Research, *Socio-Economic Study of Possible Eight-Hour Ozone Standard,* Rpt SR96-06-01, June 4, 1996). This analysis of meeting approximately an 0.08 3AX ozone standard in the Chicago-Lake Michigan area alone pegs the costs of going *part way* to meeting the standard at $2.5 billion (compared with EPA's $2.6 billion national estimate), with Chicago getting only about 50% of the VOC reductions it needs. Note, then that **API's cost estimate for the Lake Michigan Area alone equals EPA's for the *nation!***

EPA's cost estimates would be far higher if they had not assumed that Chicago would virtually attain the proposed standard in 2007, *without further controls then already planned or required.* API, in contrast, finds that Chicago cannot even meet the current standard without additional controls.

EPA's cost estimates would be far higher if they had used known, but relatively expensive, technologies in their analysis. EPA's rationale for avoiding "extreme" measures because we "know such measures will not be put in place" is unconvincing and even cynical. If industry really knew such measures would not be put in place, there wouldn't be the firestorm of protest we now have. As a consequence of this rationale, the cost analysis is very uninformative.

EPA's cost estimates would be far higher if they had not made two assumptions: (i) costs of attainment in marginal nonattainment areas are assumed to be zero; (ii) areas are considered in attainment if they are able to reduce emissions to at least 75% of the targeted reductions.

EPA's cost estimates would be higher if they had used some of the cost estimates in the literature. One example is that for the enhanced I&M program. EPA estimates the cost at $6.70 per vehicle, or $500 per ton VOC reduced It is so low because of a $160/repaired vehicle offset for fuel efficiency gains (assuming 10% of the vehicles are repaired). Independent analysts have estimated costs of $4,000-$5,000 per ton VOC reduced. As another example, EPA assumes that open burning bans result in large reductions in emissions at zero costs. There are no free lunches. An additional example is that EPA assumes that there will be increases in rule-effectiveness that deliver VOC reductions at $2,000 per ton. If such reductions could be had at this price, they would already have been implemented.

For the PM-fine standard, specifically, EPA's cost estimates would be higher if they has not assumed that only the 470 counties in the U.S. that have PM10 monitors are eligible for being in violation of the proposed PM2.5 standard. There is no reason to expect this limitation, given the estimates for long-range transport of PM precursors, as expressed in EPA's own Regional Acid Deposition Model (RADM). EPA's promise to add a few additional counties to this set in its next RIA is not sufficient.

There are some significant sources of *upward bias* in the EPA cost estimates for ozone and PM, however.

EPA's cost estimates would be lower if economic incentive approaches were considered. These approaches, while posing a harder challenge to cost estimation, would reduce cost estimates compared to using engineering approaches.

EPA's cost estimates would be lower to the extent that there are innovations in abatement and production/consumption processes (none were assumed by EPA). EPA did not provide forecasts of innovation, yet relies on innovation for its claim that meeting the proposed standards is feasible.

EPA's cost estimates would be lower if episodic controls were included as a possible control strategy. This strategy is very promising for reducing costs, although its use is clouded by language in the Clean Air Act appearing to bar its use in nonattainment areas.

EPA's cost estimates for ozone and PM combined would be lower than the costs of each counted separately, because these air pollutants share common precursors. This argument should not be pushed too far, however. EPA finds that the major common precursor (NOx) is responsible for only 13% of the PM-fine inventory in the East and 22% in the West. So the scope for double-counting costs is limited. EPA is currently redoing the RIA to examine this issue.

The overall conclusion from the above analysis is that the costs of reaching attainment of the proposed standards for both ozone and PM-fine are likely to be very high, but poor analysis from EPA does not provide a basis for credible estimates.

Benefits

EPA estimates that the health benefits associated with reducing ozone are small relative to the costs and relative to the health benefits from reducing particulates. EPA's benefit analyses have a number of flaws that bias them upwards and some that bias them downwards.

For ozone benefits, the major bias is a downward one: it has been hypothesized that cumulative ozone exposure reduces the elasticity of the lung, which, over time, can result in shortness of breath and lung disease. As yet, there are no quantitative relationships available on this endpoint and both the current and the proposed standards would not protect against such cumulative exposure effects.

For PM, the major biases are upwards. EPA's benefit analysis has two major problems, not yet discussed in public (i.e., not counting the recent error discovered in the EPA interpretation of the Pope et al (1995) study). The first is a technical matter concerning the second most valuable health reduction -- avoiding a case of chronic bronchitis.

Estimates of this value in the RIA rely on a conjoint analysis that describes a serious, rather than a typical, case of chronic bronchitis. For this reason, EPA's so-called "812" (retrospective) study adjusted the value of preventing a case downwards, using a study by myself and Maureen Cropper (University of Maryland and the World Bank). This necessary adjustment reduces the benefits attributed to this endpoint by about half.

The second is a much more profound problem. The traditional approach to placing values on changes in the risk of mortality is to estimate the change in the mortality rate associated with a change in pollution, translate this change into the number of deaths "averted" per year, and multiply this by the "value of a statistical life." The latter is, formally, the willingness to pay (WTP) for a small change in the risk of death divided by that risk change. Studies providing such values used samples of relatively healthy individuals with an average age of 40 and valued WTP today to reduce risk of accidental death *today*.

In contrast, particles are thought to overwhelmingly affect older individuals, most of whom have compromised health. So for most of the population, the relevant question is how much they would be willing to pay today for a small increase in life expectancy. The Pope et al. (1995) study, which EPA relies on for its high-end mortality estimates, finds that a 1 ug/m3 change in sulfates translates into about a 1 month change in life expectancy for a person enjoying this lower sulfate level over their lifetime (and a far smaller change when the pollution change is only for one year). It would greatly aid the debate if this kind of life-expectancy formulation of mortality risk were to replace the "body count" approach as used in the RIAs and in the traditional health benefits literature.

For the valuation of changes in life expectancy, there is only one study in the economics literature.[3] Using this flawed, but suggestive, study results in a far lower estimate of mortality risk reduction benefits than that from reliance on the traditional approach -- a low enough estimate to question the RIA's favorable benefit-cost comparison for PM.

IV. Recommendations for Congress

Congress could take one of two paths in introducing cost-benefit analysis into standard setting. If the Clean Air Act is not to be reopened, Congress can perhaps find a vehicle for issuing an interpretation of the Act that:

1.a. once science has provided the foundation for the Administrator's policy judgment, consideration of the benefits and costs of alternative standards to further inform that judgment is permissible under the Act.

If the Act is to be reopened, then:

[3] M. Johannesson and P. Johansson. 1996. "To Be or Not to Be, That is the Question: An Empirical Study of the WTP for an Increased Life Expectancy at an Advanced Age," *Journal of Risk and Uncertainty*, **13** (2), pp. 163-174.

1.b. Congress should reconsider Section 109 to permit the Administrator to consider, along with the science, a range of social factors, including costs and benefits, in her decisions on the stringency of the NAAQSs.

Congress can remedy the disconnect between the criterion for setting the NAAQS -- which assumes that there is a threshold below which there is a "margin of safety" -- and the underlying health science -- which finds no thresholds. Once the threshold idea is eliminated, there is no logical "stopping point" in setting the standard, except one that tries to balance the benefits of a tighter standard against the costs from doing so. The key idea is that society has scarce resources and it may be that resources going to a further tightening of the NAAQS may have a higher value somewhere else -- in education, in other types of public health programs, in a healthier, more vital economy. The health effects of poverty are probably far greater than those of air pollution. Public officials should be required to consider this possibility which, in practice, means considering the costs and benefits of their actions.

At the same time, efficiency considerations cannot and should not be the sole criterion for making major governmental decisions. Equity and ethical concerns may be just as important, or even more important. But, furthering social economic welfare is also important and should be considered along with these other concerns.

A possible variation on the recommendation 1.b. above, and one that gives more emphasis on health protection, is:

3. Consider a two-stage standard-setting process. In the first stage, minimum health protection standards would be identified. If EPA proposed a standard no more stringent than this, the process would stop. If the proposal were more strict then, in a second stage, EPA would be required to show that the costs of a tighter standard are justified by the benefits (both health and non-health). This proposal could be elaborated for such determinations to be made on a regional basis, resulting in non-uniform, but more efficient, standards.

This proposal has a number of advantages. It would engage the country in a national debate about what health protections are essential (in the sense of being worth *any* cost). It could also lead to a frank discussion about the need to establish priorities and acknowledge resource tradeoffs of the kind addressed in benefit-cost analysis. Also, it would give equal standing to non-health effects of pollution reductions. Why should such effects be given lower standing *a priori?* It may be the case that people care more about certain types of environmental improvements than certain types of health improvements. Finally, permitting a departure from uniform national standards would recognize that the costs and benefits of reducing pollution are quite different in different parts of the country because of meteorology and other natural conditions, industrial composition, and socio-demographic characteristics.

Appendix A
Cost-Benefit Analysis[4]

CBA is a technique intended to improve the quality of public policy decisions, using as a metric a monetary measure of the aggregate change in individual well-being resulting from a policy decision. Individual welfare is assumed to depend on the satisfaction of individual preferences, and monetary measures of welfare change are derived by observing how much individuals are willing to pay, i.e., willing to give up in terms of other consumption opportunities. This approach can be applied to nonmarket "public goods" like environmental quality or environmental risk reduction as well as to market goods and services, though the measurement of nonmarket values is more challenging. Cost-effectiveness analysis (CEA) is a subset of cost-benefit analysis in which a policy outcome (e.g., a specified reduction of ambient pollution concentration) is taken as given and the analysis seeks to identify the least-cost means for achieving the goal (taking into account any ancillary benefits of alternative actions as well).

To its adherents, the advantages of CBA (and CEA) include transparency and the resulting potential for engendering accountability; the provision of a framework for consistent data collection and identification of gaps and uncertainty in knowledge; and, with the use of a money metric, the ability to aggregate dissimilar effects, such as those on health, visibility, and crops, into one measure of net benefits. Criticisms of CBA hinge on questions about a) the assumption that individual well-being can be characterized in terms of preference satisfaction; b) the assumption that aggregate social well-being can be expressed as an aggregation (usually just a simple summation) of individual social welfare; c) the empirical problems encountered in quantifying economic value and aggregating measures of individual welfare.

We take a) as axiomatic, noting also that because CEA is a subset of CBA, philosophical objections to the use of a preference-based approach to individual welfare measurement apply equally to both. For b) we agree that CBA does not incorporate all factors that can and should influence judgments on the social worth of a policy, and that individual preference satisfaction is not the only factor. Nevertheless, we assert that CBA must be included as a key factor. Other arguments under c) are measurement problems -- how choices based on preferences permit can one to infer economic values in practice.

The state of the science of measuring such economic values is exceedingly active. Estimates of the willingness to pay for reductions in mortality and morbidity risks, for avoiding environmental damages to recreation opportunities, and for avoiding visibility degradation, are the most active and successful areas of valuation. Issues of a higher order stalk the estimation of nonuse values, and a variety of mostly empirical concerns have left materials damages poorly understood. Estimation of the costs of reducing environmental effects, while generally thought to be relatively straightforward, are found to be at least as challenging as estimating the benefits, although there are easy-to-estimate, but perhaps, poor proxies for the loss in social well-being such costs represent.

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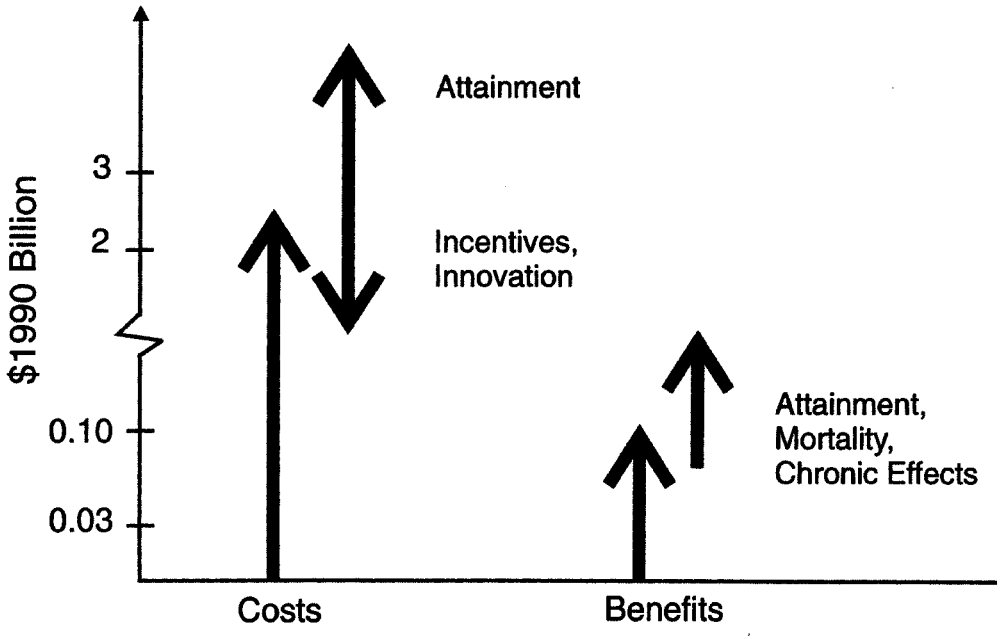
[4] Extracted from *Cost-Benefit Analysis and Regulatory Reform,* Raymond Kopp, Alan Krupnick, and Michael Toman, Resources for the Future, for the Commission on Risk Assessment and Risk Management, June 6, 1996.

EPA's Ozone RIA

Estimated Costs, Benefits of 8 hour, 0.08 ppm, 1-4 AX Standard



-Panel II-

THE IMPLEMENTATION OF THE NEW NAAQS FOR OZONE AND FINE PARTICLES

Testimony of

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Senior Fellow
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before the
Subcommittee on Clean Air, Wetlands,
Private Property and Nuclear Safety of the
Committee on Environment and Public Works
United States Senate
Washington, D.C.

Thursday, April 24, 1997

Mr. Chairman and distinguished committee members. Thank you for inviting me to testify on implementation issues associated with the EPA's proposed ozone and PM NAAQSs. I am pleased to provide you with my ideas and judgments on the issues, from my perspective as a professional environmental economist, based on sixteen years of experience at Resources for the Future (RFF), many of them spent on issues associated with the Clean Air Act and the design of environmental policies. RFF is an independent, non-partisan research and educational organization concerning itself with environmental and natural resource issues. In addition, I currently co-chair (with OAQPS Director John Seitz) the Clean Air Act Advisory Committee's Subcommittee on Ozone, Particulate Matter, and Regional Haze Implementation Programs. This is the body that Administrator Browner hopes will develop ideas for reducing costs of meeting whatever standards are promulgated. Also, I have recently served as a senior economist on the Council of Economic Advisors, with primary responsibility for the environmental and natural resource portfolio. While at CEA I worked on a number of Clean Air Act issues, including EPA's preliminary planning for analyses required to re-promulgate the NAAQS for ozone. Also, I want to emphasize that the views I present today are entirely my own.

The Main Message

The proposed standards, if they become law, are likely to be incredibly expensive to implement. The Administrator has clearly endorsed cost-effectiveness as a major criterion for developing an implementation strategy. Your job is to help EPA live up to this goal and to remove any impediments posed by the CAA.

Below, I assume that the proposed standards will go into effect and then discuss the consequences and the possibilities. First, the high costs of meeting the standards is discussed, followed by an examination of the activities of the Subcommittee on Ozone, Particulates and Regional Haze Implementation programs, my observations about the FACA and the issues it is taking up, followed by a discussion about actions that Congress should take.

Cost of Meeting the Ozone and PM Standards (for details in this section, see my testimony in Panel I: The Proposed NAAQSs for Ozone and PM, before this same subcommittee, April 24, 1997),

By EPA's own analyses (in its November, 1996 Regulatory Impact Analyses (RIAs) for Ozone and PM), the cost of going *part way* to meeting the ozone standard will be $2.6 billion and the cost of going *part way* to meeting the fine particle standard will be $6 billion, annually. These sums do not come close to bringing the country into attainment. For ozone, Chicago needs a 44% reduction in volatile organic compounds (VOCs) to go from the 2007 baseline ozone concentration to a 0.08 1AX standard[1] but gets 14%;

[1] This means a standard of 0.08 ppm with the highest 8-hour reading in each of three years averaged. If this value is greater than 0.084 ppm, the area is in violation.

Baltimore/Washington needs 66% VOC reductions but gets 14%; New York needs 79% but gets 16%; Los Angeles needs 90%, but gets 9%. For PM, the northeast U.S. is estimated to need an 86% reduction in PM2.5 concentrations from baseline, but EPA can only find and cost out technologies to deliver 16% of what the region needs. The same types of estimates apply to other regions.

The use of economic incentive approaches (which EPA did not include in its analyses) and innovations in pollution abatement and other technologies (which EPA did not analyze) may hold down cost increases. But, in truth, the analyses are so flawed that we have very little idea of what the costs will be -- only that they will be very large relative to current costs unless major changes are made to the way in which the standards are implemented.

The distribution of the costs of the new standards may have some interesting aspects if long-range transport is significant (currently being debated by OTAG). If an area is newly classified as nonattainment (NA), the CAA planning apparatus and various mandates will comes down on them (without the type of changes being discussed by our FACA (see below)). A current NA area may now have help in reaching attainment if it is downwind of previously less or un-regulated polluters. With more areas designated NA, more of these less regulated sources will come into the SIP program. States along the east coast may be helped. But, these states will have to do much more on their own than they are doing now, because the standards are so much tighter. For the general public, there will be some shocks. In new NA areas, inspection and maintenance (IM) programs are very likely to be implemented (under the current system, at least).

The Federal Advisory Subcommittee on Ozone, Particulates, and Regional Haze Implementation Programs (the FACA)

As co-chair of the Subcommittee (with OAQPS's Director John Seitz), I want to apprise the Senate of the work of our group.

The U.S. Environmental Protection Agency (EPA) established the Subcommittee for Ozone, Particulate Matter, and Regional Haze Implementation Programs (Subcommittee) in September 1995 as a part of the Clean Air Act Advisory Committee (CAAAC), under the authority of the Federal Advisory Committee Act (FACA. Given the potential for significant changes in national air quality standards and related implementation programs in 1997, as well as the existing information about common sources and atmospheric processes leading to formation of ozone, particulate matter and regional haze, EPA believed it was important to initiate a process through which it could obtain advice and recommendations from a broad group of stakeholders on possible new integrated and cost-effective approaches to attaining the NAAQS and reducing regional haze. I was approached to bring an economic perspective to the subcommittee.

At the time of its April 1997 meeting, the Subcommittee was composed of 82 members

representing a broad range of interests in air quality management, including State, local, and tribal governments, environmental and public interest organizations, industry, small business, members of federal agencies and academia. Five work groups were formed to assist the Subcommittee: the Base Programs Analyses and Policies Work Group (BPAPWG), the National and Regional Strategies Work Group (NRSWG), the Science and Technical Support Work Group (STSWG), the Communications and Outreach Work Group (COWG) and the Coordination Group. Together, the work groups involve more than 100 additional individuals and interested organizations contributing to the overall advisory committee process.

Upon their formation, the work groups identified priority issues to address and assigned lead authors for various "issue papers." An issue paper describes the background of the particular air quality management issue, options for addressing it, and pros and cons of each option. Where possible, the issue paper includes word group recommendations to the Subcommittee. Work group members were charged to develop innovative solutions to issues even if they were outside of the current regulatory framework set by the Clean Air Act. The determination of whether any proposed solutions fall outside of the authority of the CAA is an on-going process. During the first phase of its discussions, the Subcommittee considered 15 issues papers, drafted and presented principally by representatives from the BPAPWG and NRSWG. Representatives from the STSWG have played a significant role in the development of the issue papers as well, through joint authorship and responses to specific technical questions. Although few specific consensus recommendations have been made so far, the Subcommittee and associated work groups have made significant progress in identifying options, discussing pros and cons for many critical air quality management issues, and agreeing on principles by which options in particular areas should be evaluated.

The Subcommittee will continue throughout 1997 with the goal of providing EPA with input and, if possible, consensus recommendations on issues critical to the development of EPA's Phase II implementation strategy (scheduled for proposal in June 1998). This proposal is intended to address strategies for achieving cost-effective emissions reductions that allow attainment of the NAAQS and reductions in regional haze impairment.[2]

Table 1 attempts to categorize the overall degree of consensus reached by the Subcommittee on the various issue papers that were discussed through the November 1996 meeting.[3]

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[2] Taken substantially from Federal Advisory Committee Act (FACA) Subcommittee for Ozone, Particulate Matter and Regional Haze Implementation Programs *Initial Report on Subcommittee Discussions Through November 1996*, Final Report, April, 1997.

[3] Taken from FACA (1997), *ibid.*

Table 1. Overview of Subcommittee Discussions Through November 1996

Issue Paper	Lead Work Group	Consensus Category	Continue Discussion in 1997
Designation Issues for New NAAQS	BPAP; NRS	II	
How Should AOIs be Determined?	NRS	II	
Update on AOV / AOI Concepts	NRS	II	Y
Attainment Dates	BPAP	II	Y
Economic Incentives	NRS	II	Y
Incentives for Monitoring	BPAP	IV	Y
Institutional Mechanisms	NRS	II	Y
Integrated Implementation of the Ozone and PM NAAQS and Regional Haze Rules	NRS	II	Y
New Sources: Considerations for the Implementation of New Air Quality Standards	BPAP; NRS	IV	Y
Options for Designating PM-fine Areas	EPA Staff*	III	
Regional Haze	NRS	IV	
Technical Discussion on the Integration of Ozone, Fine Particle, and Regional Haze Air Quality Management	EPA Staff*	NA	
Treatment of Areas in Which Air Quality Trends Indicate the Risk of Becoming an AOV	BPAP	IV	

Consensus Categories

I. - Subcommittee reached consensus supporting the recommendations presented in the issue paper.

II. Subcommittee could not reach consensus on the recommendations, but agrees with the range of options presented in the issue paper.

III. Subcommittee could not reach consensus or agree on a limited set of options, but could reach consensus on a set of principles.

IV. Subcommittee could not reach consensus or agree on a limited set of options or principles.

* Prepared by EPA staff in support of the Subcommittee

Because of strong disagreement and current Subcommittee work load priorities, the Coordination Group recommended that the Implementation of a "Too Close to Call" Designation and Population Weighting of Monitors issue papers not be reworked at this time.

As co-chair of the subcommittee, I have the following observations about our work.

- The FACA is a useful body for developing new ideas on implementation. Such ideas are sorely needed to reduce the already enormous costs of meeting the NAAQS and to hold down costs of meeting the proposed NAAQS. The FACA's purview to examine the ozone and PM standards together places it in a particularly useful position to find benefits of integrating these programs. In this regard, and in many other ways, the FACA goes far beyond the charge and interests of the Ozone Transport Assessment Group.

- *The members of the FACA want to try and reach consensus.* The value to all participants of presenting EPA with detailed ideas that have agreement from a diverse set of stakeholders is well understood.

- The progress that has been made is due in no small part to EPA's strategy of studied neutrality (while emphasizing that it retains its responsibility to issue regulations that it views as appropriate), and willingness to lend its considerable expertise to the FACA's efforts. The FACA and work group members have been working extraordinarily hard to develop issue papers, present them, and develop consensus on their contents.

- *The FACA cannot work miracles.* It is a large, diverse body of stakeholders operating in an advisory role. The key dynamic within the FACA is between industry and the environmental members: the former want cost-reductions, the latter want greater certainty of attainment. The states want greater autonomy from EPA but generally are willing to participate in regional planning organizations. This mix of stakeholders has resulted in lively discussions and many new ideas. However, consensus is as yet lacking on most of these, primarily because the members are waiting to see and negotiate on the entire package.

- Progress has also been limited because no decisions have been made on the ozone and PM standards. Once these are settled, the subcommittee's deliberations are likely to become more intense.

- Even if consensus is reached, there is no guarantee that the consensus recommendations will be as cost-effective as they might be, simply because the negotiation process will demand some trading off of cost savings for certainty in attainment and other criteria.

- Even if a consensus is reached, EPA may choose to ignore aspects of the agreements. The FACA is only an *advisory* body. EPA may come up with what it considers better ideas, or it may find that some suggestions run afoul of the Clean Air Act (see below).

• EPA is severely limited by the Clean Air Act in its ability to implement new ideas (see below).

• There are a number of measures that I believe have promise to reduce costs below what they otherwise would be. Some are presented below. Let me emphasize that this choice of measures is entirely my own, is only a partial list of measures discussed by the FACA, and is not meant to pre-judge the outcome of the FACA, where many of these measures are only beginning to be discussed.

— Regional cap and trade program for NOx
— Regional Air Management Partnerships (RAMPs) to perform a variety of duties related to regional transport and common precursors for ozone and PM
— Reasonable Progress measurements better tied to concentration performance; credit now for future emissions reductions
— New Source Review: lowering technology floor in a trading program
— Cost per ton Ceiling with Clean Air Fund
— Economic incentives for mobile/area source reductions
— Episodic Controls for Ozone

• *A NOx Trading Program.*

A culture shift away from command and control to emissions trading programs has taken place at EPA, as evidenced by EPA's embrace of SO2 allowance trading, the Agency's Open Market Trading Rule[4], and its support for NOx trading in the northeast's Ozone Transport Commission and the eastern U.S.'s Ozone Transport Assessment Group (OTAG). Still, EPA lacks the authority to impose a trading program. To a large extent, the RAMP process (see below) is meant to address this vacuum. However, many observers question whether a voluntary trading program can work.

The FACA is closely examining how a regional NOx trading market can be designed. Consideration is being given to establishing trading ratios between regions at ratios other than one-to-one to reflect the effects of long-range transport. Consideration is also being given to including mobile sources in the trading program, insofar as including vehicle manufacturers and/or fleet owners.

• *The RAMP*

To address the long range transport of both ozone and PM-fine, Regional Air Management Partnerships would be formed to include states and tribes with common air quality problems, i.e., including areas of influence (AOIs), where source emissions

[4] Open Market Trading Rule for Ozone Smog Precursors FR Aug 3 1995 (Volume 60, Number 149).

contribute to areas violating the standards (AOVs) (like nonattainment areas under the current system). All states would be a member of at least one RAMP. RAMPs would identify AOIs and assist in development of Regional Integrated Plans (RIPs), which would be the place to consider region-wide market-based mechanisms. States/tribes or EPA would designate AOVs and EPA would approve the RAMP's AOIs. The states and tribes in an AOI would prepare RIPs, which would provide the basis for the states' Implementation Plans.

- *Reasonable Further Progress Reform.*

Serious consideration is being given to (i) basing measures of progress on "effective" emissions, which would account for the effect of location, "stack" height, HC species, and other factors on ozone and PM concentrations, rather than assuming that "all tons are equal" as in the current RFP system; (ii) giving states flexibility to define RFP that is appropriate for their particular conditions; (iii) permitting states to take credit in the present for programs reducing emissions in the future (such as programs affecting land use).

- *New Source Review.*

New sources wishing to locate in nonattainment areas must install expensive abatement technologies to meet LAER requirements under the CAA. New sources outside such areas must install BACT. If such sources are part of a cap and trade system in the Area of Influence, they should be permitted to trade for meeting these technology requirements. The argument against this proposal -- that hot spots may be created -- could be addressed, in part, by requiring a technology floor, but one less stringent than LAER/BACT.

- *Cost per ton Ceiling.*

Part of the controversy over attaining the new NAAQS is the fear that costs will be prohibitive. EPA, in its RIA, tries to calm such fears by noting that "extreme measures are not modeled because they would never be implemented." To give pollution sources greater certainty in this regard, consideration is being given to setting a cost/ton ceiling along with establishing a Clean Air Fund. Polluters would have the option of paying into this fund the ceiling price per ton of emissions in lieu of abatement. The resulting fund could be used to fund reductions in pollution that lie outside of the State Implementation Plan process.

- *Greater Emphasis on Economic Incentives Applied to Mobile and Area Sources.*

The FACA is poised to address economic incentives as they apply to mobile and area sources. One intriguing possibility (being considered in detail by another subcommittee of the Clean Air Act Advisory Committee) is to shift emphasis away from inspection and maintenance (I&M) programs as we currently know them to on-

board mobile source emissions monitoring technologies (OBDII). With 10 percent of the vehicles responsible for 50 percent of vehicle emissions, finding such vehicles and getting them fixed or scrapped should be a major priority. Enhanced I&M is a clumsy and expensive way to do this. New technologies for real-time monitoring of vehicle emissions, including remote and on-board sensing, hold significant promise for cheaply developing in-use emissions information to identify gross polluters for I&M programs and can serve as the foundation for other economic incentive programs, such as vehicle emissions fees (being considered in the South Coast), that target actual emissions.

Another possibility applied to mobile sources is to base vehicle registration fees on the vehicle's mileage, a strategy that can be revenue-neutral on average while increasing the marginal cost of driving.

Further reductions in the sulfur content of diesel fuel and in sulfur in gasoline may be cost-effective ways of reducing fine particle concentrations, if refineries can trade and bank emissions reductions, as they did during the period where lead was being phased out of gasoline.

Emissions from off-road diesel and gasoline use have been largely uncontrolled. Low-cost abatement approaches may exist in this category.

California's Area Source Alternative Compliance Program is an attempt to induce voluntary controls by areas sources who would earn credits available for sale to point and mobile sources within the state's control programs.

- *Episodic control programs for ozone.*

With the possible exception of Los Angeles, areas classified as violating the ozone standard are actually in compliance the vast majority of the time. The average number of exceedance-days annually (excluding LA) is 5.2 and the median number is 2.3. Only 3 areas out of 43 are out of compliance more than 10 days. As most ozone violations are part of multi-day episodes, this represents from 3-4 episodes a year, on average. [5] Put more dramatically, the standard was violated less than one-half of one percent of the monitor-hours in each city. Further, in the 1984-85 period, there were no cities showing more than 64 hours in violations at the worst monitor.

This skewed temporal distribution of violations presents obvious opportunities for episodic controls -- strategies and measures to reduce ozone precursors on the few days where conditions warrant. Such controls would involve issuing a public warning in advance of meteorological conditions usually associated with high ozone, which

[5] Based on 1991-1993 nonattainment areas. Areas which had experienced an average of 0 exceedances are omitted from the calculation, as is Los Angeles, leaving 43 out of 91 nonattainment areas in the tabulation. The mean *including* areas which had experienced 0 exceedances was 2.52 and the median was 0.

would trigger a set of prearranged modifications to the behavior of ozone emitters. For instance, large stationary sources might cut back or shift output to different hours, produce products with lower emissions (VOCs from spray painting activities vary by the color of the paint), employers might shift to a flexible work schedule to reduce early morning traffic congestion, public transportation costs might be reduced, etc. Episodic controls could reduce the number of days requiring precursor emissions reductions substantially. With an ideal forecasting system, this number could be reduced from the entire three-month summer season, to about the number of days per year with weather conducive to ozone formation.

Efforts to develop voluntary episodic control programs are on-going in a number of localities. Some regions, such as Baltimore and Chicago, have worked to develop public-private partnerships to bring about episodic reductions in emissions of ozone precursors across a broad array of economic sectors. These programs also extend to government agencies and individuals, particularly with respect to transportation choices.

One obstacle to the acceptance of substituting episodic controls for continuous controls on air pollutants is the concern that the former would redistribute rather than reduce the production of the pollutant. However ozone's unique tendency to form in significant concentrations only on days with certain meteorological characteristics makes it the perfect candidate for episodic control. A mix of NOx and VOCs on a warm, humid, sunny day will likely produce ozone, whereas on a cold, cloudy day it will not. Moving the emission of large quantities of VOCs and NOx away from the few days per year likely to produce ozone will typically not defer the production of ozone to another time, but rather may prevent its formation altogether.

What Congress Can Do?

I. Affirm EPA's Interpretation of Subpart 2, Title I of the Clean Air Act Amendments of 1990. Congress should make it clear that it supports EPA's interpretation of this section of the CAA, which is that a change in the form and/or level of the ozone standard invalidates this section. This interpretation in based on the idea that the nonattainment area classification system developed in this section (moderate, severe, extreme, etc.) is tied to the current standard, becoming null if a new standard is set. Affirmation is essential if the highly prescriptive and expensive mandates contained in this section are to be re-examined.

II. Open the Clean Air Act. The Clean Air Act significantly restricts EPA's ability to implement a number of cost-effective ideas that have been raised by the various FACA members and workgroups. Congress should re-open the Clean Air Act to:

- Facilitate the creation of regional trading institutions. The FACA membership generally agrees with the concept of forming regional planning institutions to account for regional transport. Upwind states are unlikely to make major reductions that benefit downwind states without being required to participate.

- Eliminate LAER/BACT requirements for new source review. A trading cap and minimum technology standards should help eliminate hot spots and fears that new plants will shop for pollution havens, while creating more emissions to trade, thereby enhancing the efficiency of the trading market.

- Make it clear that episodic use of controls to reduce ozone episodes are creditable towards Reasonable Further Progress and for use in attainment demonstrations. Effects of such a strategy on meeting other goals (e.g., reducing nitrates in the Chesapeake Bay) must be taken into account.

- Provide EPA with the authority to require that states adopt specific cost-effective policies and measures as part of their SIPs. EPA clearly lacks this authority now. In granting such authority, Congress should require EPA to demonstrate that its guidelines and/or requirements for implementing the standards, as well as the control strategies it implements directly, meet a cost-effectiveness test.

- Title II of the Clean Air Act may inhibit EPA's ability to reduce mobile source emissions in a timely and cost-effective fashion. Reopen this title to renewed scrutiny, in light of the new standards.

- Title IV's SO2 allowance trading program has been very successful. However, a tighter cap and a program coordinated with Title I may be needed to help meet a fine particle standard and an ozone standard cost-effectively. Reopen this title in light of the new standards.

III. Increase and target funding for monitoring

Both the ozone and fine particle PM standards cannot be effectively implemented without better monitoring. Problems include:

- There are few fine particle monitors and fewer still with speciation capabilities.
- The PM Reference method is inaccurate for California (readings are too low because volatized nitrates are not being captured).
- There are few rural ozone monitors.

Congress needs to appropriate additional funds for a major augmented air quality monitoring program. Provide these funds as a line item in the EPA budget.

IV. Increase Funding for Health and Economic Research.

Although EPA's Office of Research and Development has targeted health effects from PM and ozone for special attention, funding levels are too low. In addition, ORD does not have programs funding economic research (except for a small program in the Office of Exploratory Research and a special small program on valuation of environmental damage being run jointly by EPA and the National Science Foundation). Such research is needed for developing improved methods of cost estimation and methods to value health and environmental damages, as well as for the collection and analysis of data on human behavior to aid in the design of more effective and efficient economic incentive policies.

PREPARED STATEMENT OF MARY NICHOLS, ASSISTANT ADMINISTRATOR, OFFICE OF AIR AND RADIATION, U.S. ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman, Members of the Subcommittee, thank you for inviting me to discuss the implementation efforts associated with the Environmental Protection Agency's (EPA's) proposed revisions to the national ambient air quality standards for particulate matter and ozone.

For 26 years, the Clean Air Act has promised American adults and American children that they will be protected from the harmful effects of dirty air—based on best available science. Thus far, when you consider how the country has grown since the Act was first passed, it has been a tremendous success. Since 1970, while the U.S. population is up 28 percent, vehicle miles traveled are up 116 percent and the gross domestic product has expanded by 99 percent, emissions of the six major pollutants or their precursors have *dropped* by 29 percent.

The Clinton Administration views protecting public health and the environment as one of its highest priorities. We have prided ourselves on protecting the most vulnerable among us—especially our children—from the harmful effects of pollution. When it comes to the Clean Air Act, we take very seriously the responsibility the Congress gave us to set air quality standards that "protect public health with an adequate margin of safety"—based on the best science available.

The Clean Air Act requires EPA every 5 years to review national ambient air quality standards and, if necessary, revise them to reflect the best available science. This standard-setting process includes extensive scientific peer review from experts outside of EPA and the Federal Government. After 3½ years of scientific peer review and public involvement, based on our reading of the best available science, the Administrator has proposed new standards for particulate matter and ozone that we believe are required to protect the health of the American people.

As you know, at this point we have only *proposed* revisions to the standards for these two pollutants. We take very seriously our obligation to carefully consider all public comments on these proposals before making a final decision. We have heard from small businesses, industry, State and local governments, Federal agencies, and other citizens like the elderly, children, doctors and people with asthma. While we have proposed specific levels for each pollutant, we have also asked for comment on a wide range of alternative options. We do not intend to make a final decision until we have carefully considered comments on all of those alternative options.

Throughout the history of the Clean Air Act, national ambient air quality standards have been established based on an assessment of the science concerning the effects of air pollution on public health and welfare. Costs of meeting the standards and related factors have never been considered in setting the national ambient air quality standards themselves. This has been the case through six Presidential administrations and 14 Congresses, and has been reviewed by the courts. We believe this approach is appropriate.

In choosing proposed levels for the ozone and particulate matter standards, EPA's focus has been entirely on health, risk, exposure and damage to the environment. Sensitive populations like children, the elderly and asthmatics deserve to be protected from the harmful effects of air pollution. And the American public deserves to know whether the air in its cities and counties is safe or not; that question should never be confused with the separate issues of how long it may take or how much it may cost to reduce pollution to safe levels. Indeed, to allow costs and related factors to influence the determination of what levels protect public health would be to mislead the American public in a very fundamental way.

However, once we revise any air quality standard, it is both appropriate and, indeed, critical that we work with States, local governments, industry, Federal agencies, and others to develop the most cost-effective, common-sense strategies and programs possible to meet those new health standards. Under the Clean Air Act, States have primary responsibility for devising and enforcing implementation plans to meet the national air quality standards. We are determined to work with States and others to ensure a smooth transition from efforts to implement the current standards with efforts to implement any new standards. And we have been actively working to do just that.

By 1995 it became apparent from the emerging body of science that we may have to propose revisions to one or both of the ozone or particulate matter national ambient air quality standards, as well as fulfill our obligations on developing a regional haze program. At that time we determined that the best way to meet the goal of developing common-sense implementation strategies was to bring in experts from around the Nation to provide us their advice and insights. As a result, we used the Federal Advisory Committee Act to establish a Subcommittee for Ozone, Particulate Matter and Regional Haze Implementation Programs. John Seitz, Director of my Of-

fice of Air Quality Planning and Standards, co-chairs that Subcommittee, along with Alan Krupnick from Resources for the Future, Inc. The Subcommittee is composed of about 75 representatives from State and local government, industry, small business, environmental groups, other Federal agencies and other groups. It also includes five working groups comprised of another 100 or so members of these same kinds of organizations.

The Subcommittee and the various workgroups have been meeting regularly for over 18 months to hammer out strategies for EPA and the States to consider in implementing any revised standards. Members from industry, State governments and others are putting forward position papers advocating innovative ways to meet air quality standards. It is our belief that results from this Subcommittee process are leading to innovative approaches for implementing any new standards. The Subcommittee will continue to meet over the next year to help develop cost-effective, common-sense implementation programs.

The questions being addressed by the Subcommittee include:

• What will be the new deadlines for meeting any new standards? [If EPA tightens a standard, it has the authority to establish deadlines of up to 10 years—with the possibility of two additional 1-year extensions—beyond the date an area is designated "nonattainment."]

• What will be the size of the area considered "nonattainment"? [If it revises an air quality standard, EPA has the ability to establish the size of the affected nonattainment areas and focus control efforts on those areas that are causing the pollution problems, not just the downwind areas that are monitoring unhealthy air.]

• How do we address the problem of the pollutants that form ozone and/or fine particles being transported hundreds of miles and contributing to nonattainment problems in downwind areas?

• What kinds of control strategies are appropriate for various nonattainment areas? Can we use the experience of the past several years to help States target those control strategies that are the most cost-effective?

• How can we promote innovative, market-based air pollution control strategies?

The implementation of revised standards is likely to focus on sources like cars, trucks, buses, power plants and cleaner fuels. In some areas, as with the current standards, our analysis shows that reaching the standards will present substantial challenges. All of the air pollution control programs we are pursuing to meet the current ozone and particulate matter standards, as well as certain programs to implement other sections of the Clean Air Act, will help meet any revised standards. For example, the sulfur dioxide reductions achieved by the acid rain program will greatly reduce levels of fine particles, particularly in the eastern United States. Cleaner technology in power plants would greatly reduce the nitrogen oxides that help form ozone across the eastern United States.

In announcing the proposed ozone and particulate matter standards last November, we initiated steps to obtain even broader views from stakeholders on implementation strategies. We expanded the membership of the Federal Advisory Subcommittee to include more representation from small business and local governments. Also, in conjunction with the Small Business Administration and the Office of Management and Budget, we are holding meetings with representatives of small businesses and local governments to obtain their input and views on how best to implement our proposed standards.

We intend to announce our proposals on implementation of the proposed new standards in phases that correspond to the Subcommittee's schedule for deliberating on various aspects of the program. The Administrator has stated her intention to propose the first phase of the implementation program at the same time that we announce our final decision on revisions to the ozone and particulate matter standards.

Mr. Chairman, this concludes my written statement. I will be happy to answer any questions that you might have.

PREPARED STATEMENT OF BENJAMIN Y. COOPER, SENIOR VICE PRESIDENT, PRINTING INDUSTRIES OF AMERICA

Mr. Chairman and members of the Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety, I want to thank you for the opportunity to testify on the proposed revision of the National Ambient Air Quality Standards for ozone and particulate matter. My name is Benjamin Y. Cooper. I am senior vice president for the Printing Industries of America. I appear before you today in behalf of PIA and the Small Business Legislative Council. The Printing Industries of America is the nation's largest graphic arts association with more than 14,000 members. The Small

Business Legislative Council is a permanent coalition of nearly 100 trade associations. This year, I have the privilege to serve as chairman of SBLC.

The Printing Industries of America and I as the industry's representative have extensive experience working with the Environmental Protection Agency and State government on environmental matters. I have served as a member of EPA's Clean Air Act Advisory Committee since it was formed following the passage of the 1990 Amendments to the Act. I subsequently was appointed to the subcommittee charged with advising EPA on the implementation of the new standards. I have also been appointed to the Small Entity Caucus and the Small Entity Review Team at EPA to provide information on the impact of the implementation of the standards on small business. Further, the industry is one of EPA's Common Sense Initiative sectors and a partner in the Design for the Environment project. Finally, we have been involved for nearly 4 years with the Council of Great Lakes Governors and the Environmental Defense Fund in the Great Printers Project, a major pollution prevention project for our industry. The EPA has been a strong supporter of this project.

In addition to these specific projects, PIA along with the National Federation of Independent Business and the American Furniture Manufacturers' Association lobbied successfully for the passage of the Small Business Technical Assistance Amendment to the 1990 Clean Air Act Amendments. This program known as the "507" program after the section of the Act has been enormously successful despite underfunding and has become a model for small business programs in other environmental legislation.

My purpose in outlining these activities is to establish the fact that we are an industry which is working to support positive environmental actions. We are not alone. Many small business groups are working on similar projects. As you know, small business is uniquely tied to its community A good, sustainable environmental policy is critical to the future of these businesses.

I want to address several issues connected to the NAAQS proposal, but I want to say at the outset that EPA and the Administrator have done a great deal to open communication with small business and to explore opportunities for alternative paths to compliance. While EPA's work with small business continues to have room for improvement, it is our opinion that EPA does more than any Federal agency in seeking the cooperation of small business. We meet regularly with senior officials at EPA on a variety of topics including regular meetings with Deputy Administrator Fred Hansen. Further, the EPA Small Business Ombudsman continues to provide a level of service to which all agencies should aspire. Now I wish to highlight our concerns with the proposed standards and their implementation plans:

THE STANDARD IS NOT NECESSARY

We understand the Clean Air Act's requirements for a review of the scientific and health data and the need to make changes in the NAAQS when the data suggests a need to do so. What we do not understand is how a change can be suggested when the air is steadily improving and when the 1990 amendments to the Clean Air Act have not yet been fully implemented. In fact, significant portions of the Act have not been implemented. It would have been a genuine surprise if the health and science advisors to EPA had come back with a conclusion that there is no relationship between air pollutants and health. It is also an obvious conclusion to suggest that the cleaner the air the less adverse affect on health. It is quite a leap in logic to say that because of these conclusions, the entire nation has to undergo an extremely expensive regulatory adventure which may or may not achieve the desired results.

There is an assumption that the Federal Government must set a standard for the nation—including its States and localities and its businesses or progress will stop. In fact, State, localities, small printing company owners and other small businesses believe we have as much as, if not a greater, stake in a clean environment than the Administrator. Printers work with State officials on a regular basis to develop programs to improve compliance where it is required or voluntary reductions of emissions where compliance is not required. The printing industry has cooperative projects in Illinois, Michigan, Minnesota, Wisconsin, Massachusetts, Florida, Ohio and Texas. Other States are examining similar opportunities. In virtually all of these instances, the vast majority of the companies participating in the programs are too small to be considered major sources under the current Clean Air Act or under State programs. Instead, these companies are seeking ways to reduce emissions of all types as good management practice. These are all actions which have been generated at the State level in full cooperation with the businesses in the States. In fact, with the exception of very large companies in our industry, regula-

tion of printing companies is done at the State level. Our members would argue that the States are doing their job aggressively.

EPA'S DATA BASE IS FLAWED

EPA has based much of its activities to date and predicates future activities on an assessment of the emissions from various industries. For example, EPA estimates the volatile organic compounds released by the printing industry is approximately 101,000 tons, making printing the fifth largest source of VOC's among stationery sources. This data may be correct but neither we nor they could verify it. Their information is taken from models based on permits supplemented with other types of industry information; however, permits are not accurate. It is instructive to understand the real world of permits to understand this point.

Permits are not issued based on what a company does but on what a company is capable of doing or what it might do under certain circumstances. Further, if the company hopes to get more business, it has to buy a bigger permit than it may currently need to accommodate the growth.

One of the most contentious issues emerging from the Clean Air Act Amendments of 1990 was that emissions are based not on actual emissions but the potential to emit. To date, PTE as it is known has been calculated in most parts of the country as operating 24 hours per day throughout the year at full capacity. Clearly no one does this. Printing company owners probably dream of being able to use their equipment to full capacity. PTE can be modified if a company can prove through emission monitoring that their actual emissions are lower. Unfortunately, small business has difficulty coming up with such proof since monitoring emissions is very costly.

The EPA is currently in the process of revising its rules on PTE and we believe the revisions will be satisfactory. However, the current figures issued by EPA are based on existing calculations. It is entirely possible that if EPA had the resources to study the emissions from the printing industry, they would find that we do not have the amount of emissions they project. In addition, in the printing industry, three types of sources are subject to Federal controls-gravure, flexographic and large heatset web printing companies. The rest of the industry has an altogether different emission profile from these companies; therefore, conclusions drawn from one of the three printing processes with Federal standards do not apply to the rest of the industry. It is our understanding that other small business industries have similar problems.

EPA DOES NOT HAVE ADEQUATE GUIDANCE FOR THE STATES

One of the long-standing issues between the printing industry and EPA has been the development and publication of control techniques guidelines (CTG). Twice in the past 17 years, EPA has begun a CTG project for the industry and twice has abandoned the project. In the first case, EPA completed a significant portion of the CTG, but stopped the project when industry objections to their conclusions reached a critical stage. Nevertheless, the draft-with its flaws-was released to the States.

That draft CTG in the early 1980's created significant problems for us since States were regulating based on faulty conclusions. In the 1990 Amendments, EPA was required to complete work on 12 CTG's. We were to have been one of these CTGs. However, despite completing most of the work, the document was never completed. EPA made available an Alternative Control Techniques document. Unfortunately, failure to complete the CTG left the industry without the kind of uniform guidance which would have resolved many difficulties at the State and local level. Issuance of a CTG by EPA means that the guidance described is used by the States whereas an ATC merely provides examples of processes.

We are attempting to get this project back on track at EPA since consistent guidance would reduce regulatory costs for us and enforcement costs for the States and EPA. We have had recent meetings with EPA officials and we believe this matter may be finally be resolved.

One of the major problems faced by EPA is having to make technical decision regarding U.S. industry. These industries are complex and must be thoroughly understood in order to issue good regulations. This is a time consuming and costly process but absent the process, industries such as printing are faced with regulations that do not make sense and do not improve air quality. EPA's problems are magnified when the industry is predominantly small businesses such as printing. It is clear that the agency should devote more of its resources to this level of activity well in advance of enforcement activities.

SMALL BUSINESS WILL BE HARDEST HIT BY THE NEW STANDARDS

We have heard that EPA plans to target certain industrial segments under the new NAAQS. Further, we have been lead to believe that if the emissions can be achieved from these sources, it will not be necessary to go after small sources. Unfortunately, life in the environmental regulation community does not work that way.

EPA rarely regulates small business directly. Small business is subject to regulations by States and regions under State implementation plans or SIPS. These SIPS lay out the plan for reducing emissions through an area. Establishment of a SIP is often a political fight. Small business falls into the category known as area sources. Typically, a State must reduce a target amount from such area sources. This is often done by a percentage basis-telling all companies of a certain size to reduce by a specific percentages on an industry basis-lowering the level at which companies in an industry must be permitted. At that point, the agency often issues control requirements known as Reasonably Available Control Technology. If the technology requirement is inappropriate, the industry in faced with a fight to change the proposal. This is done on an area by area basis. Emission reductions on area sources is a regulatory version of carpet bombing.

While the problems on large businesses are no less onerous, they are generally armed with specialists to meet with the agency. Large sources may even have an opportunity to negotiate timetables or control strategies. Small business rarely has such help.

It is also rare that small companies have the resources to implement the kind of controls required by the agency. Sometimes the control are add-on devices which in our industry can cost millions of dollars. Other times the requirements are "process controls" where the printer has to change the chemistry of the printing process. Some of these changes are practical; some are not. Government officials have proposed total enclosure of printing presses as a control option leaving the obvious difficulty of getting the press operator safely to the press. We have had process controls recommended which compromise the printing process itself. Often these controls are suggested in advance of thorough review. Often industry protests are ignored until substantial resources have been invested to produce counter arguments.

From a purely political standpoint, it is often easier for a State agency to apply a general 10 percent emission reduction requirements on a large group of area sources than to apply a costly engineering control on one or a relative handful of very large sources. Often the small sources do not know what has hit them until the process is over.

The development of the NAAQS standards is typical of what happens to small business. Many in the small business segment were caught by surprise at EPA's plans. While the printing industry has been represented at many of the meetings, there was very little small business representation until recently. It was only after the proposals had been issued and a good portion of the work of the implementation subcommittee had been finished that small business was invited to begin meeting with EPA. Fortunately, it may not be too late for small business to influence the process and EPA officials seem to be genuinely interested in our views.

EPA SHOULD PROVIDE A REGULATORY IMPACT ANALYSIS

We have been in an ongoing discussion with EPA about whether or not various laws apply to this proposed new standard and its implementation. Candidly, for most of us in small business, we cannot understand why an agency would not want to thoroughly gauge the impact of a regulation on small business. We have never understood why any arm of government would have to be forced by law to assess the harm that may result from an agency action. In the case of the current proposal, any delay or cost impact of the analysis would be more than offset by the positive results of such analysis.

We recommend that EPA take this concept one step further by aggressively seeking ways to limit the adverse affect of the proposals on small business. Since the Act does not require EPA to include small sources in the Federal program, it could use the implementation strategy to develop clear alternative programs for small business.

THE IMPLEMENTATION PROPOSAL MAY BE TOO CONFUSING

EPA is reviewing various recommendations from the implementation subcommittee of the Clean Air Act Advisory Committee which would change areas to which the new standards would be applied. These new areas known as areas of influence and areas of violation would replace the current designations for non-attainment. We would urge careful consideration of the impact of these new areas on small busi-

ness. While the current regime may not provide the ideal framework for dealing with every air emission problem, the business community-including the small business community-understands attainment and non-attainment. Whenever possible, we should avoid the implementation of new terms of bureaucratic management such as AOV's, AOI's, RAMP'S and RIP'S. These new terms would be in addition to SIPS.

WE THOUGHT THE AGE OF COMMAND AND CONTROL REGULATION WAS OVER

We keep hearing that the age of command and control regulation is over and yet we keep getting new commands. As I outlined above, the printing industry has involved itself in as many projects as EPA has offered. We want to participate, learn and improve; however, if this new standard goes into effect, I could not encourage our industry to engage in similar projects in the future. What is the point of working toward consensus on environmental issues when the final step in the process is to raise the bar? An argument could be made that an industry which waits for regulations rather than seek change may spend fewer resources in the long run. It would be ironic if the proposal by Administrator Browner had the effect of killing the projects which have marked her service at EPA.

WHAT DO WE RECOMMEND

1. We know that EPA must review the NAAQS periodically. If the Administrator is convinced that this standard is necessary, it should only be implemented when it is clear that the current standard is no longer achieving the desired results. One way of approaching the new proposal is to make it conditional subject to review after the full implementation of the current Act.

2. At a minimum, a final decision on the proposed standard should be delayed until a full inventory of current emissions from industry has been developed and subjected to thorough review. Further, the standard seems to need additional scientific and medical review. Additional time would assure that such review can occur.

3. EPA should be specifically required to conduct a thorough regulatory impact analysis. This standard has the potential to permanently drive manufacturing away from significant portions of the U.S. and make it virtually impossible for any inner city to attract manufacturing jobs. We do not believe this should be a burden to the agency but an opportunity.

4. EPA should be required to fully implement the 1990 Clean Air Act amendments before embarking on a new regulatory plan. An example of this includes the 507 programs referenced above. While the full implementation of these programs is required under the Act as a condition of SIP approval, most States do not have adequate programs. Many States are cutting back on such programs due to the pressure from EPA for enforcement. Despite what we hear about the end of command and control, it is command and control that gets the funds while help and information get short-changed.

5. Finally, EPA has an unprecedented opportunity to practice what it preaches. As we have said, there is nothing in the Act that requires EPA to regulate small business. In fact, as we have stated, most of the regulations on small business come at the State level under pressure from EPA. EPA has the power to provide incentives to the States to deal with small sources through technical and educational assistance. Under such a plan, States could be given credits toward their SIPS equal to the emissions contribution from area sources for properly implemented technical assistance programs. The reality is that neither EPA nor the States have the resources to follow through on command and control activities. The agency may be amazed to find that if you provide guidance and help, small companies may just do the right thing.

PREPARED STATEMENT OF PAT LEYDEN, DEPUTY EXECUTIVE OFFICER, SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Good morning Mr. Chairman and members of the Committee. It is a pleasure to be here. My name is Pat Leyden and I am a Deputy Executive Officer at the South Coast Air Quality Management District in Southern California.

As the Senate considers the proposed new air pollution health standards, a number of important implementation issues warrant discussion. We need to understand:

- what types of sources are likely to be subject to additional clean-up requirements:
- how much time will be allowed to achieve the standards; and

• how can we accomplish our objectives with equity and at the lowest possible cost.

I have had the honor of working for the District on air pollution abatement for the last 8 years. I am responsible for rules, permits, and enforcement for all of the stationary sources in our air basin. Much progress has been made; but, we still have the worst air quality in the Nation. Thus, my job involves a continuous effort to find the least painful path to clean air.

Without apology—I can tell you that I have written and implemented some of the toughest command-and-control air pollution regulations in the world. But, I am also here to tell you that I think there is a better way.

I'd like to take just a few moments and tell you about our success with the use of market-based strategies, such as emissions trading programs. In particular, I'll focus on our mass cap program, called RECLAIM. Then, I'll close with a few comments on the potential use of trading programs to achieve the proposed new health standards.

I. RECLAIM

RECLAIM is the nation's largest multi-industry emissions trading program. RECLAIM stands for Regional Clean Air Incentives Market. Over 330 of our largest pollution sources have a mass emissions facility cap that declines annually. The program covers facilities that emit four tons or more a year of either Nitrogen Oxide (NO_X) or Sulfur Oxide (SO_X). The types of industries included are: refineries, power plants, cement kilns, aerospace, food manufacturing, textiles, metal melting, hotels, and even amusement parks. Facilities under RECLAIM have the flexibility to choose the least expensive way to reduce emissions. If they reduce more than required, they can sell credits to other facilities. The program is mandatory and all reductions will be accomplished by the year 2003. RECLAIM replaced 32 command-and-control rules. In both the NO_X and SO_X markets, these facilities will cut their emissions by almost two-thirds. *(Note, the specific emissions reductions are: 73 percent for the NO_X* market and 63 percent for the SO_X market.)

This type of commitment to reducing pollution did not come from a vacuum or simple good will. Dirty air, political resolve and the cost of command-and-control rules created the momentum. For 2 years, over a thousand individuals, companies, and organizations worked with the District, the State, and EPA to forge the regulations. It goes without saying that there were major battles along the way, over every detail from starting allocations to emissions monitoring. In the end, EPA, the Governor of California, and over 80 percent of the companies affected urged the adoption of the regulation.

RECLAIM went into effect in January, 1994. After 3 years of implementation, the success of the program has exceeded our initial expectations. In brief, here is the report card.

• Actual emissions are a third lower than allocations. *(Note: Use of historic emissions allowed companies an allocation slightly higher than actual emissions for the first 3 years. Some groups were concerned that this would result in an increase in pollution. This has not been the case.)*

• Facility compliance is better than seen in many command and control rules. Actual Emissions are reported daily from computerized Continuous Emission Monitors for 85 percent of the market, smaller sources use non-resettable fuel meters. Public knowledge of total emissions is vastly superior to command-and-control. Compliance at the end of the first year was 87 percent, and rose to 92 percent at the end of the second year. Even higher compliance is anticipated at the end of the third year.

• Trading of excess emissions to support increases in production and plant modernization has exceeded expectations. To date, more than $33 million have been traded. The cost per ton of each pollutant is well below national averages for the cost of emissions control. *(Note: The price of NO_X*, for the year 2000 and beyond ranges from $1,500 to $1,700/ton; for the same period the price of SO_X is $2,000/ton.)

• Job loss attributed to RECLAIM has been dramatically lower than what was forecast for the command-and-control rules that it replaced. *(Note: The job loss for the command-and-control rules was estimated at 2,013 jobs forgone annually. The RECLAIM job loss was less than 4 percent of the forecast in the first year, and less than 2 percent in the second year.)*

• Under RECLAIM, the cost of achieving emission reductions has been cut almost in half. The final story on actual costs won't be available until all emissions are reduced in the year 2003. However, based on the first 3 years of reductions, it appears that the initial estimate of an annual cost savings of 42 percent under-estimated

reality. *(Note: the command-and-control cost was estimated at $139 m/yr, compared to the RECLAIM estimated cost of $80 m/yr.)*

RECLAIM works. It not only works for the companies now in the program, it suggests that the power of emissions trading in the marketplace should be used to lower the costs of compliance for other companies as well. To this end, the District has adopted numerous rules for voluntary excess credits to be produced from mobile and area sources. These credits can currently be used by RECLAIM sources. The District hopes to be able to broaden their use to other sources.

RECLAIM is a success story about reducing emissions from burning fuel. As the Senate assesses the new air pollution health standards, this consideration of what works is especially germane.

II. THE NEW STANDARDS AND ADDITIONAL EMISSION REDUCTIONS

In many parts of the country, the new standard may require sources to meet emission limits similar to those in place in California. Control strategies will vary region by region, depending on the composition of each area's emissions inventory, and the severity of the non-attainment problem.

The District's initial analysis of the proposed new standards leads to the conclusion that the driving force for additional emission reductions will come from the 2.5 particulate standard. After 2 years of inventory analysis, at a cost of $1.3 million, the South Coast Air Basin has some of the best data in the Nation on what sources contribute to the small particulate problem. Meeting the new standard will require additional emission reductions from fuel combustion sources. In our region, we estimate that an additional 35 percent reduction may be required.

Our largest contributors are doing what is needed under RECLAIM. Additional reductions will need to be considered from other sources. High on the list of priorities will be diesel sources, including those regulated at the Federal level. A few examples are: ships, trains, planes, interstate trucks, and off-road construction and agricultural equipment.

In addition, many small sources have protected status under the Clean Air Act, even though their emissions can be lowered by today's technology. Some examples include: refrigerators, stoves, and small internal combustion engines. Although individually small, these sources add up. It has been estimated that the emissions from small internal combustion engines is today greater than the largest power plant in our air basin.

Our RECLAIM experience illustrates that compliance costs can be lowered when there are differential costs of control between sources in a market. The classic advice of economists is true. The market does incentivize the development and use of low-cost reductions. The procedures to verify emissions from fuel burning are now well-established for most types of sources. This allows emission credits to be a blue chip investment in the marketplace.

III. CONCLUSIONS

Members of the Committee, I'll close with a few summary observations.

First, the South Coast Air Quality Management District supports the new standards. Our No. 1 request is for adequate time to achieve the new target. We cannot be held to our current deadline of the year 2010. Additional time will be needed.

Second, trading programs are important tools to be used in implementing the proposed new standards. Trading programs are not a magic, painless potion. There are significant costs to cleaning our air. There will be hard tradeoffs as we push for cleaner fuels, equipment, and products. Trading programs do not decrease government's work in developing plans or rules, permitting sources, or assuring compliance. But, they do give businesses much greater flexibility and offer the promise of significantly lowering the price tag.

For RECLAIM to have been adopted, a strong political will to clean up the air was required. For RECLAIM to be a success, a strong partnership was needed with business and the environmental community. The same will be true as the Senate considers the new standards.

Mr. Chairman and members of the Committee, thank you for the opportunity to speak.

RESPONSES BY PAT LEYDEN TO QUESTIONS FROM SENATOR LIEBERMAN

Question 1. How has air quality in the SCAQMD improved since 1970? Why do you think SCAQMD was able to make good progress in cleaning up the air?

Response. Past air quality programs have resulted in dramatic improvements in Basin air quality. In spite of the growth in population and vehicle miles traveled, ozone levels have been reduced in half over the past 30 years, sulfur dioxide and lead standards have been met, and other pollutant concentrations have significantly declined. And, for the first time in 1992, the Federal annual nitrogen dioxide standard was not exceeded in the Basin. However, the Basin still experiences exceedances of health-based standards for ozone, carbon monoxide, and particulate matter under ten microns (PM_{10}).

These dramatic improvements in Basin air quality are the direct result of a long-term comprehensive strategy to reduce emissions from stationary, mobile and area sources. This strategy included highly innovative and often the Nation's most stringent pollution control programs, such as conventional stationary source control programs, as well as new market-based programs such as RECLAIM (REgional CLean Air Incentives Market), mobile source tailpipe standards and reformulated gasoline, and consumer product regulations.

Figures 1–1 through 1–4 demonstrate graphically the improvements in air quality over the last two decades. Figure 1–1 demonstrates the significant decrease in the number of days exceeding State and Federal ozone standards, health advisory and episode levels for the years 1976–1996, while Figure 1–2 demonstrates the significant reduction of the maximum ozone concentrations recorded in the Basin for the years 1955–1996. Figures 1–3 and 1–4 show the downward trend of the number of days exceeding the Federal standards, and State standards, respectively, for the years 1976–1996.

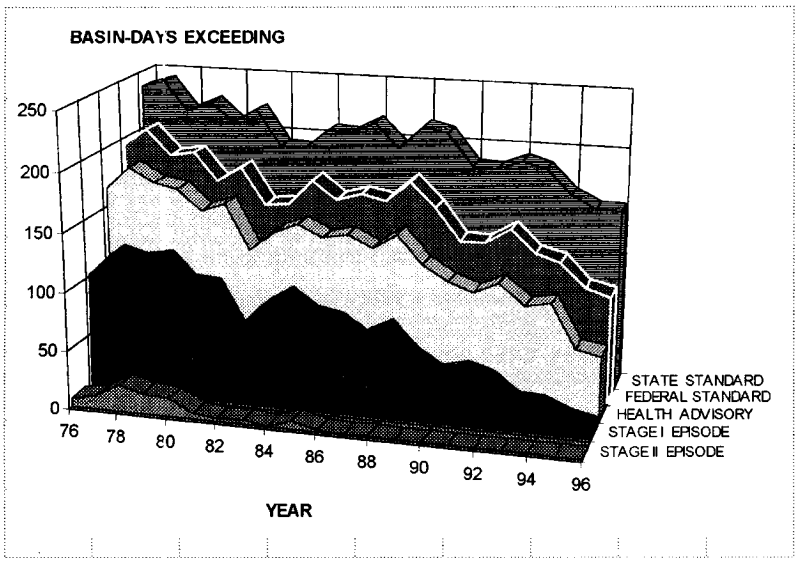


FIGURE 1-1 - OZONE

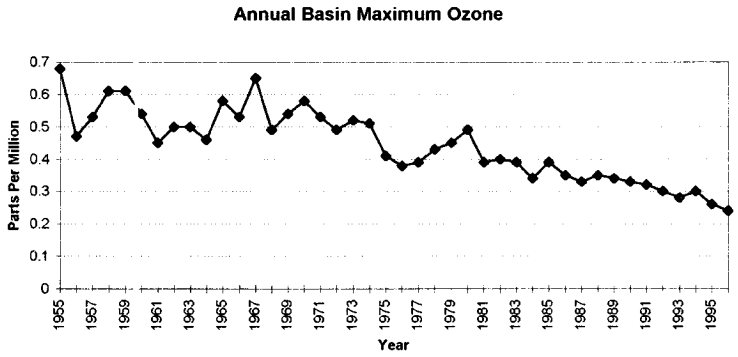


Figure 1-2 MAXIMUM OZONE CONCENTRATIONS

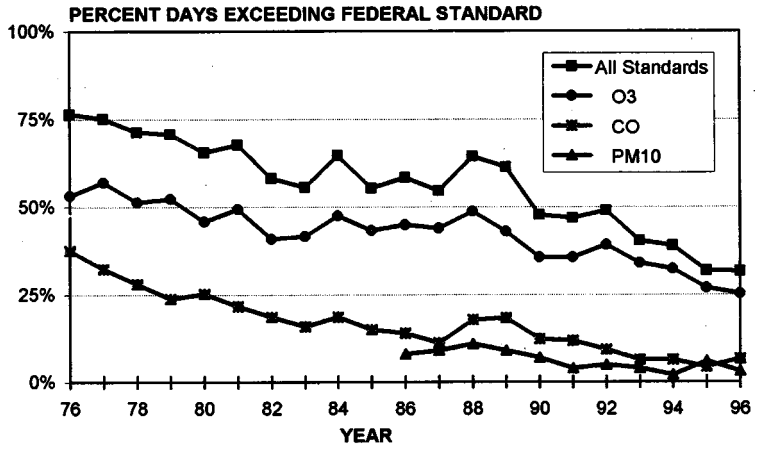


Figure 1-3 - FEDERAL STANDARDS

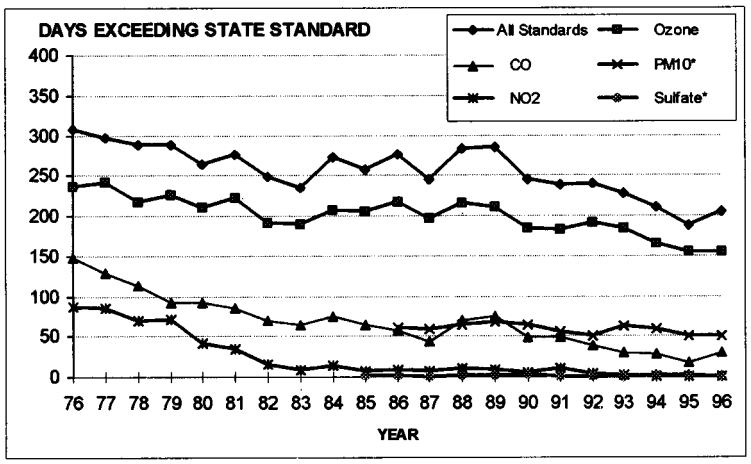


Figure 1-4 - STATE STANDARDS

Question 2. From your experience, has industry developed new technologies that were not available at the time of enactment of air quality standards? What do you think the impact might have been if SCAQMD had waited before all technologies were available to set the standard?

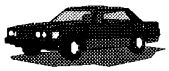
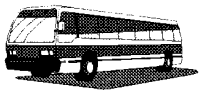
Response. This question can be answered by breaking it down into four other easy questions. First, is today's technology significantly cleaner than it was 27 years ago when the current Federal air standards were first adopted? Yes. Every major emissions category is both cleaner and more efficient. This is true for mobile sources (cars, trucks, and buses), volatile organic products (solvents, and coatings), and energy sources (boilers, turbines, and engines). The attached charts show advancements in these areas over the last 10 years or so.

Second, did the health standards create demand for cleaner products? Yes. Over and over again the story has repeated itself. The incentive to reduce emissions by reformulating products and designing cleaner fuels and engines has consistently been driven by the public demand for clean air. Each step along this road was taken with intense debate over cost, technology and timing.

Third, would today's clean air progress have been achieved if the health standards had been based on current technology? Hardly. In fact, mix 1970's technology with 1997's population, and the South Coast Air Basin would have air pollution like Mexico or Eastern Europe. The attached chart illustrates the dramatic reduction in emissions seen in a number of basic emission sources.

Fourth and final question; are significant technology advances needed for most of the Nation to meet the proposed new standards? No. Although there are real costs associated with cleaner fuels and new equipment, most regions should be able to achieve the standards with the steady step-by-step application and advancement of known technology.

TECHNOLOGY ADVANCEMENT
Defined By Average Emission Limits

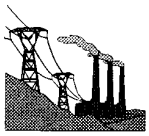
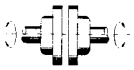
SOURCES	1987-1990	1997-2000
		
Passenger Cars		
- VOC (grams/mile)	0.41	0.07
- NOx (grams/mile)	0.70	0.20
Trucks		
- NOx (grams/bhp-hr)	6.00	4.00
- PM (grams/bhp-hr)	0.60	0.10
		
Buses		
- NOx (grams/bhp-hr)	6.00	4.00
- PM (grams/bhp-hr)	0.60	0.05
Architecture	**VOC - g/l**	**VOC - g/l**
- Non-Flat Coatings	380	100
- General Primers, Sealers, and Undercoaters	350	100

TECHNOLOGY ADVANCEMENT
Defined By Average Emission Limits

SOURCES	1987-1990	1997-2000
Solvents - Maint. Cleaning - Polyester Resin	**VOC - g/l** 900 200	**VOC - g/l** 50 50
Aerospace - Maskant - Chemical Processing - Adhesive Bonding Primer	**VOC - g/l** 1200 850	**VOC - g/l** 750 250
Metal Coatings - Vacuum Metalizing - Etching Filler	**VOC - g/l** 800 720	**VOC - g/l** 420 420
Solvent Degreasers	**VOC - g/l** 900	**VOC - g/l** Aqueous Solvents 50*

* Proposed To Be Adopted

TECHNOLOGY ADVANCEMENT
Defined By Average Emission Limits

SOURCES	1987-1990	1997-2000
 Power Plants - SCE - LADWP	**NOx - Lb/Mw-hr** 1.1 1.6	**NOx - Lb/Mw-hr** 0.15 0.15
 Internal Combustion Engine - 50 - 500 HP - > 500 HP	**NOx - ppm** no limits	**NOx - ppm** 45 36
Turbines - 0.3 < 2.9 MW - Over 2.9 MW	**NOx - ppm** no limits	**NOx - ppm** 25 9 - 15
Glass Melting - Glass Melting Furnace	**NOx - Lb/ton Glass** 5.5	**NOx - Lb/ton Glass** 1.2

Question 3. What type of integrated strategies for PM and ozone has the AQMD developed?

Response. Historically, the AQMD has proposed a comprehensive control plan to address all criteria pollutants. Since the 1989 Air Quality Management Plan (AQMP) and throughout its successive revisions (including the recently adopted 1997 AQMP), the AQMD has proposed an integrated strategy to achieve the air quality standards for both PM_{10} and ozone (as well as the other criteria pollutants). In designing a comprehensive plan to meet the ozone and PM standards, all feasible and cost-effective control measures are identified, with a focus on measures that reduce precursors of both ozone and PM_{10}. For example, in determining the level of VOC vs. NO_X controls for ozone attainment demonstration, the contribution of NO_X emissions to the formation of PM_{10} and $PM_{2.5}$ in the air basin plays a significant role in determining the optimal level of NO_X controls. This integrated approach leads to the most cost-effective path to clean air for all air quality standards. Control of other PM and its precursors, such as oxides of sulfur, elemental carbon, ammonia, and fugitive dust, are included in the overall control strategy for all criteria pollutants in this region. Tables 7–3 and 7–6 from the 1997 AQMP (see attached) detail the integrated control strategy by measure and targeted pollutant(s).

TABLE 7-3

1997 AQMP Control Measures, Implementing Agency, Adoption Date and Implementation Period

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
SHORT- AND INTERMEDIATE-TERM MEASURES				
Surface Coating and Solvent Use				
CTS-02E	Emission Reductions from Adhesives (Rule 1168) (VOC)	SCAQMD/ ARB	2000	2007-2010
CTS-02H	Emission Reductions from Metal Parts and Products (Rule 1107) (VOC)	SCAQMD	1997	1998-2000
CTS-02M	Emission Reductions from Plastic, Rubber, Glass Coatings (Rule 1145) (VOC)	SCAQMD	1997	1998-2000
CTS-02N	Emission Reductions from Solvent Degreasers (Rule 1122) (VOC)	SCAQMD/ ARB	1997	2000-2005
CTS-02O	Emission Reductions from Solvent Usage (Rule 442) (VOC)	SCAQMD	2000	2000-2005
CTS-03	Consumer Product Education Labeling Program (VOC)	SCAQMD	1998	2000-2005
CTS-04	Public Awareness/Education Programs - Area Sources (VOC)	SCAQMD	1998	2000-2005
CTS-07	Further Emission Reductions from Architectural Coatings (Rule 1113) (VOC)	SCAQMD	1996	1998
CP-02	Emission Reductions from Consumer Products (VOC)	ARB	1997	2005-2008
DPR-01	Emission Reductions from Pesticide Applications (VOC)	DPR	1997	2005

TABLE 7-3

(continued)

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
Petroleum Operations and Fugitive Emissions				
FUG-03	Further Emission Reductions from Floating Roof Tanks (Rule 463) (VOC)	SCAQMD	1999	2000
FUG-04	Further Emission Reduction from Fugitive Sources (Rule 1173) (VOC)	SCAQMD	1997	1997
Combustion Sources				
CMB-02B	Emission Reduction from Small Boilers and Process Heaters (NO_x)	SCAQMD	1997	1999
CMB-03	Area Source Credit Programs (All)	SCAQMD	1997	1997-2000
CMB-04	Area Source Credits for Energy Conservation/ Efficiency (NO_x)	SCAQMD	1997	1997-2000
CMB-06	Emission Standards for New Commercial and Residential Water Heaters	SCAQMD	1999	2003-2013
CMB-07	Emission Reductions from Petroleum Refinery Flares (All)	SCAQMD	1999	2000
CMB-09	Emission Reductions from Petroleum Refinery FCCUs (PM_{10})	SCAQMD	1997	1998-1999
Fugitive Dust				
BCM-01	Emission Reductions from Paved Roads (Rule 403) (PM_{10})	SCAQMD, Local Government, CalTrans	1997	1997
BCM-03	Further Emission Reductions from Unpaved Roads, Unpaved Parking Lots and Staging Areas (Rule 403) (PM_{10})	SCAQMD, Local Government	1997	1997-2006

TABLE 7-3

(continued)

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
Fugitive Dust (Cont.)				
BCM-04	Emission Reductions from Agricultural Activities (Rule 403) (PM_{10})	SCAQMD, USDA Natural Resources Conservation Service	1997	1997-1999
BCM-06	Emission Reductions from Fugitive Dust Sources to meet Best Available Control Measures Requirements (Rule 403) (PM_{10})	SCAQMD,	1997	1997
Miscellaneous Sources				
MSC-01	Promotion of Lighter Color Roofing and Road Materials and Tree Planting Programs (All Pollutants)	SCAQMD, Local Government	1999	2000
MSC-02	In-Use Compliance Program for Air Pollution Control Equipment (All Pollutants)	SCAQMD	1997	1998
MSC-03	Promotion of Catalyst-Surface Coating Technology Programs (All Pollutants)	SCAQMD	1998	2000-2004
PRC-01	Emission Reductions from Woodworking Operations (PM_{10})	SCAQMD	1997	1998
PRC-03	Emission Reductions from Restaurant Operations (VOC, PM_{10})	SCAQMD	1997	2000-2004
WST-01	Emission Reductions from Livestock Waste (VOC, PM_{10}, Ammonia)	SCAQMD	1998	2004-2006
WST-02	Emission Reductions from Composting (VOC, PM_{10}, Ammonia)	SCAQMD	1998	2004-2006
WST-03	Waste Burning (Rule 444) (VOC)	SCAQMD	1997	1997-2010

TABLE 7-3

(continued)

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
Miscellaneous Sources (Cont.)				
WST-04	Disposal of Materials Containing Volatile Organic Compounds (VOC)	SCAQMD	1997	1998-2001
FSS -04	Emission Charges of $5,000 per Ton of VOC for Stationary Sources Emitting Over 10 Tons per Year (VOC)	SCAQMD	TBD	TBD
Compliance Flexibility Programs				
FLX-01	Intercredit Trading Program (All)	SCAQMD	1997	1997-1998
FLX-02	Air Quality Investment Program (All)	SCAQMD	1997	1997-1998
Transportation Control and Indirect Source Measures				
TCM-01	Transportation Improvements (All)	SCAG	1997	2000-2010
Advanced Transportation Technology Incentive Measures				
ATT-01	Telecommunications	The Partnership, SCAQMD, SCAG, Local Gov't	TBD	TBD
ATT-02	Advanced Shuttle Transit	The Partnership, SCAQMD, SCAG, Local Gov't	TBD	TBD
ATT-03	Zero-Emission Vehicles/Infrastructure	The Partnership, SCAQMD, SCAG, Local Gov't	TBD	1997-2010
ATT-04	Alternative Fuel Vehicles/Infrastructure	The Partnership, SCAQMD, SCAG, Local Gov't	TBD	1997-2010
ATT-05	Intelligent Vehicle Highway Systems (IVHS)	The Partnership, SCAQMD, SCAG, Local Gov't	TBD	TBD

TABLE 7-3

(continued)

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
Further Study Strategy				
FSS-02	Market-Based Transportation Pricing	State or Local Agencies	TBD	TBD
On-Road Mobile Sources				
M1	Accelerated Retirement of Light-Duty Vehicles	ARB/SCAQMD	1997	1997-2010
M4	Heavy-Duty Diesel Vehicles; Early Introduction of Low-NO_x Engines	ARB	TBD	1997-2002
M5	Heavy-Duty Diesel Vehicles; Additional NO_x Reductions in California	ARB	1997	2002
M6	Heavy-Duty Diesel Vehicles; 2.0 g/bhp-hr NO_x Standard - National	U.S. EPA	1997	2002
M7	Accelerated Retirement of Heavy-Duty Vehicles	ARB	1997	1997-2010
MON-09	In-Use Vehicle Emission Mitigation	SCAQMD	1997	1998-2010
MON-10	Emissions Reduction Credit for Truck Stop Electrification	SCAQMD	1997	1998-2010
Off-Road Mobile Sources				
M11	Industrial Equipment; Gas & LPG - California	ARB	1997	2000-2004
M12	Industrial Equipment - Gas & LPG - National	U.S. EPA	1997	2000-2004
M13	Marine Vessels; National and International Standards	U.S. EPA	1997	1998-2001
M14	Locomotives; Nationwide Standards, New and Rebuilt	U.S. EPA	1997	2000-2010
M16	Pleasure Craft; Nationwide Emission Standards	U.S. EPA	1996	1998
MOF-07	Credits for the Replacement of Existing Pleasure Craft Engines with New Lower Polluting Engines	SCAQMD	1997	1998-2010

TABLE 7-6

1997 AQMP Long Term Control Measures, Implementing Agency, Adoption Date and Implementation Period

Control Measure Number	Control Measure Name	Implementing Agency	Adoption Date	Implementation Period
LONG -TERM MEASURES				
Stationary Sources				
ADV-CP04	Consumer Products (VOC)	ARB	2001-2005	2002-2010
ADV-ARCH	Architectural Coatings (VOC)	SCAQMD	2003-2005	2006-2010
ADV-CLNG	Solvent Cleaning and Degreasing Operations (VOC)	SCAQMD	2003-2005	2006-2010
ADV-CTS	Miscellaneous Industrial Coating and Solvent Operations (VOC)	SCAQMD	2001-2004	2005-2010
ADV-FUG	Fugitive Emissions (VOC)	SCAQMD	2001-2004	2006-2010
ADV-MSC	Miscellaneous Small Sources (VOC)	SCAQMD	2002-2004	2006-2010
ADV-PRC	Industrial Process Operations (VOC)	SCAQMD	2002-2004	2006-2010
Mobile Sources				
M-2	Improved On-Road Control Technology	ARB	2000	2004-2005
M-9	Off-Road Diesel Equipment, 2.5 G/BHP-HR NO_x - California	ARB	2001	2005
M-10	Off-Road Diesel Equipment, 2.5 G/BHP-HR NO_x - National	U.S. EPA	2001	2005
M-15	Aircraft; Nationwide Emission Standards	U.S. EPA	1999	2000
ADV-ON	New Measure Development to Achieve Overall Emission Reductions - On-Road	ARB	Post-2000	2010
ADV-OFF	New Measure Development to Achieve Overall Emission Reductions - Off-Road	ARB	Post-2000	2010

Question 4. Does SCAQMD anticipate having to ban backyard barbecues as part of implementing the new standards?

Response. There has never been any plan to ban backyard barbecues. There was, however, a rule adopted 7 years ago that required manufacturers of charcoal lighter fluid to reduce volatile compound emissions by 70 percent. The myth about this rule is almost humorous. All manufacturers had their products reformulated and on the shelves for sale within just a few months. There was never a pause in the joy of backyard barbecuing, or any discernible difference in price or performance. This rule was one of the easiest steps taken to eliminate four tons of pollution from the air on a daily basis.

PREPARED STATEMENT OF BEVERLY HARTSOCK, DEPUTY DIRECTOR FOR POLICY AND REGULATORY DEVELOPMENT, TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Good morning, Chairman Inhofe and members of the Subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety of the Committee on Environment and Public Works. My name is Beverly Hartsock. I serve as the head of the Office of Policy and Regulatory Development of the Texas Natural Resource Conservation Commission (TNRCC). I am pleased to be here today to address the issue of implementing the proposed new national ambient air quality standards.

As you are probably aware, there have been a significant number of concerns raised including some by former chairs of U.S. Environmental Protection Agency's (EPA) Clean Air Scientific Advisory Committee (CASAC) in their recent testimony before a congressional committee questioning the scientific basis of EPA's proposed new air standards for ozone and particulate matter. The lack of a clear scientific basis for the levels and forms of these proposals was reflected in CASAC's closure letters to EPA on both proposals. Based on this lack of a clear "bright line" for either proposal and recent risk analysis information that indicates for some areas (Houston and Los Angeles) the current 1-hour ozone standard is more protective than the proposed 8 hour standard, the TNRCC submitted comments supporting the retention of both the existing ozone and particulate matter standards until the science to support any changes is more definitive. Attached is a letter to Ms. Carol M. Browner, EPA Administrator, from Governor Bush addressing the recent national air quality proposals. Also attached are comments from the TNRCC to EPA on the proposed revisions to the ozone standards and the particulate matter standards.

From a State regulator's standpoint, I think it's important to recognize that just adopting a new standard does not result in improving air quality. Programs must be developed to implement a new standard, and that's what my agency is expected to do. Someone must analyze current situations, understand as best possible what is causing problems that are detected, and design new programs to reduce those emissions that are significantly contributing to the problem. Those programs must maximize cost-effectiveness and sustainable development and must be phased in over a timeframe commensurate with minimizing excess cost and disruption. Progress achieved toward meeting the air quality goals established must be carefully monitored and analyzed so that mid-course corrections can be made based on actual results.

This is not a unique set of planning activities. Many programs incorporate similar steps. What is unique about air pollution control is the number of emission sources, the chemistry involved in determining cause and effect, and the meteorological variation that is inherent in the earth's weather patterns.

Chemical compounds are emitted into the air constantly from both man-made and natural sources. Some are harmless, some can be lethal. Typically, air contaminants are invisible to the naked eye. They evaporate off houses being painted, from car gas tanks being refilled, from inks drying on paper; they come from valves and pumps along piping in chemical plants, from stacks at power plants, from leaves of trees. These are but a few examples of the thousands of activities going on every day that generate air contaminants. To understand how to solve the problem of excess contaminants measured at a monitor site, we must understand not only what is being added to the air and where, but also take into account naturally occurring or background levels that in many areas are routinely 25 percent to 50 percent of the standard. Since we can't readily see the emissions, we must estimate what's happening. We require tests of emissions at large industrial plants, we require production records at small businesses, and we use formulas to guess how much is coming from cars, equipment use, consumer product use, and natural events. As you can imagine, this is an imprecise science at best, but we call it the development of an emissions inventory for an area. Gathering the data and performing necessary cal-

culations are extremely time-consuming for businesses as well as State regulatory agencies, but are necessary. The emissions inventory is the basis for estimating how much reduction is needed to solve a problem and which types of activities are candidates for additional controls.

But all this assumes that there is a problem that needs to be solved. Let's take a step back and look at how that is decided. Air contaminant monitor stations are dotted around the country. These stations are primarily focused in urban areas so we can know the quality of the air large concentrations of people are breathing. The stations are equipped with several different instruments since it takes different kinds of monitors to detect different kinds of pollutants. Thus, an ozone monitor only monitors for ozone and can't detect fine particulate matter or sulfur dioxide emissions. That requires installation of two additional monitors. The measurements made at these monitors are checked against the levels set by EPA as national standards. If monitored levels are higher than allowed, then the area is designated nonattainment. Nonattainment designation is a formal legal process including State proposals and EPA approval of designated areas. For each nonattainment area, a plan, called a State Implementation Plan, must be developed which identifies and enforceably commits the State to implement new controls on defined sources within established deadlines. Such controls can include vapor recovery at gasoline stations or marine terminals, incineration of process vent gases, use of low solvent inks, vehicle inspection and maintenance, etc.

EPA has only set a handful of national standards but one of them has been particularly difficult to attain—ozone. It's a tough standard allowing as little as 4 hours of measurements over the standard in a 3-year period of time. Many of the country's large urban areas, including four in Texas—Houston/Galveston, Dallas/Fort Worth, Beaumont/Port Arthur, and El Paso—have not yet met this standard. The new standard proposed by EPA is even more stringent. In Texas, cities like San Antonio, Austin, Corpus Christi, Longview/Marshall/Tyler, and Victoria would likely be declared nonattainment. Additional monitoring will be needed to determine the size of the new nonattainment areas, the amount of the chemical precursors in the air, and the amount of pollutant being transported into the area from neighboring areas. Planning and control program development for these new areas would also have to begin intensively if we are to meet the kind of time tables and deadlines set by the Clean Air Act and EPA. This effort will be costly and could easily serve to distract us from solving the most serious of our problems—the areas currently identified as nonattainment. It should also be noted that EPA has not proposed any funding to cover the costs.

Adoption of standards for new pollutants such as EPA has proposed with the fine particulate matter standard brings with it even greater challenges for State air regulators. As I previously mentioned, each pollutant requires its own kind of monitor. We haven't had any $PM_{2.5}$ monitors in the field since the mid–1980's. We're scrambling now to buy and begin operating some monitors, but it will be quite a while before we have the data we'll need to assess our status relative to the proposed new standard. EPA plans to allow States 3 years to install and begin operating all the monitors. This is needed because of the high cost of monitoring—for Texas, we estimate $1.3 million for fiscal year 1998, $1.8 million for fiscal year 1999, and $1.9 million for fiscal year 2000—and to allow equipment manufacturers and monitoring agencies time to prepare for this onslaught of new monitoring. Since more than 1 year of data will be needed to understand annual weather variability and to judge against the 3-year average basis that is the form of the proposed EPA standard, it will be from 3 to 6 years before we have a really good feel for how many areas of the country have air quality that doesn't meet this proposed new national standard.

Once we know where additional air quality improvements are needed, we have to understand the causes of the problem. Although there are many similarities among cities, each problem is somewhat unique and solutions will be dependent upon understanding the broad principles of air pollution and the factors unique to that area. One of the main reasons that solving our country's ozone problems has proven so difficult is that ozone is created in the air by a chemical combination of other pollutants. Trying to regulate this giant atmospheric chemistry lab that is occurring over each of our cities is taxing the limits of our scientific understanding. The variables are many and the solutions are complex. We cannot change how fast the wind blows or how much sunlight there is on a given day. Instead, we have to estimate how much emissions can be in the air from all sources—man-made or natural, industrial or personal activities—we have to assume the worst weather conditions—usually for my part of the country that means a series of hot, still days—and assess what emissions can be allowed without triggering enough of the chemical reactions to cause ozone to form at levels over the standard. Complex models have been designed to assist, but it often feels more like art than science when we try

to perform these regulatory analyses. This type of analysis is very resource intensive and often frustrating, providing less than definitive answers. And keep in mind, the results of this work are the basis for requiring new control programs that can cost billions of dollars.

We can look at the work that has been undertaken by the Ozone Transport Assessment Group (OTAG) as an example of the complexity of understanding ozone formation. OTAG has been studying air pollution transport over the 37 States in the eastern half of the U.S. for the last 2 years. The work has focused on identifying how much of the man-made and natural emissions in one area are blown to another area and how this impacts high ozone levels monitored in the mid-west, northeast and Atlanta. Ozone is formed when volatile organic compounds and oxides of nitrogen react in the presence of sunlight. There are many man-made sources of each of these types of pollutants but naturally occurring sources (primarily trees) are also an important source of organic compounds and contribute significantly to the formation of ozone. The reactions that create ozone also reverse to breakdown ozone that has been formed, so understanding the concentrations of each type of pollutant as it is being blown from one area to another is significant. With the lack of rural monitors in most areas of the country, all these analyses are computer simulated projections based primarily on meteorological data and monitored data from urban areas. Needless to say, the results are open to a lot of debate. Millions of dollars have been spent in the OTAG effort, and only four high ozone episodes have been studied. It is reasonable to estimate that similar investments will be needed to study each of our problem areas.

The proposed new fine particle standard will also require significant additional work. Once we know how much fine particulate matter is measured in each of our cities, we'll know if those cities are in attainment of the standard. But this is only the beginning of understanding what to do if they are not in attainment. We will also need to analyze the separate components of the particulate on the filters to know what chemicals are causing the problem. Knowing the chemical constituents of the fine particulate will help us to trace those chemicals back to their sources. This analysis will be crucial to understanding how to solve the problems, but just knowing chemical constituents doesn't completely define the controls needed. It tells you what types of sources are the biggest contributors to the problem. Analysis of possible control options can be targeted to these type sources. This additional chemical analysis of the particulate to determine its components further adds to the costs of the monitoring significantly. Further, these costs will continue beyond the initial startup as long as the particulate monitoring is needed. These monitoring and chemical analysis costs are in effect additional unfunded mandates on the States because EPA has not proposed adequate funding.

Analysis must not only be directed at what is likely to be causing the problem but also to what can be changed that would help solve the problem. For example, knowing that organic compounds are naturally emitted by trees helps you to understand more about the atmospheric chemical reactions, but doesn't give you any information on how to solve the ozone problem. However, knowing that organic compounds that evaporate from oil-based paints are a part of the ozone formation process leads you to examine the feasibility for phasing out oil-based paints and replacing these with latex paints. This example also illustrates another part of the control program evaluation. Timing is a key ingredient to establishing a good control program. The phase-out of oil-based paints, if allowed to occur over a number of years and with a limited number of exceptions, can be a smooth transition to a more environmentally friendly and economically sustainable way of life. If done overnight or without necessary flexibility it can put companies out of business and leave citizens unable to satisfy their needs and unhappy with the inefficiency and ineffectiveness of government programs. Traditional controls have focused on large industry; new controls will have to focus more and more on small businesses. We must take all steps possible to minimize the negative effects on our small business community.

The need to allow sufficient time to phase in controls is especially important when we look at programs to reduce emissions from the transportation sector—emissions that occur as we move ourselves or our products from place to place. Recently, I had the opportunity to listen to the EPA Office of Mobile Sources summarize their current and planned programs. Included were new car improvements like lower tail pipe emissions, on-board canisters to trap fueling emissions, and on-board diagnostics to alert car owners of system failures that could increase emissions and impair efficient vehicle operation. Also discussed were improved diesel engines for construction and farm equipment, lower emitting locomotive engines, improved small engines for lawn and garden use, and cleaner burning diesel and gasoline fuels. All of these programs, most of which are required under the current Clean Air Act, have been set in place but will require several years for equipment replace-

ment to realize actual benefits. In fact, EPA estimated that significant benefits from these programs would not be seen until 2000 and the full benefits not realized until 2020. In order to maximize the use of these programs, we must be mindful to set timeframes for accomplishing our air quality goals that match the time needed to realize the reductions from these long-term programs.

Timing is not just critical as it relates to the implementation of controls but also in proper planning. As noted earlier, it will be three to 6 years before we have good data on levels of fine particulate matter. Even for ozone where current data is much more complete, we will need to study rural levels of this pollutant to know what's being transported from one area to another. Analysis of the causes of the problems can be undertaken even as the monitoring data is being gathered. But once control measure options are identified, there must be a public process to decide the most appropriate controls to impose. This type of public process includes meetings and hearings with local planning organizations, citizens, affected businesses, and all levels of elected officials and government. Typically, these public processes take up to 18 months. After the best control options have been selected, time must be allowed for companies to install equipment, cities to make transportation system changes, and new products to be developed. The simplest of such controls can be implemented in 1 year; the more extensive industrial controls require up to 3 years for installation during process turnarounds. As previously discussed, transportation controls and new products can take up to 10 years or more to implement completely. After controls are in place, air must be monitored to see the results of these efforts. Depending on the standard, up to 3 years may be needed to measure the effects of new controls.

The planning timeframes provided by the Clean Air Act and traditional EPA guidance documents typically allow only 5 years to accomplish all of the above activities. Our experience shows that 10 years is a more reasonable planning cycle and that the more difficult air pollution. problem areas will take two or more planning cycles.

Looking for new ways to do things and learning from our experiences will be particularly important if EPA adopts new or more stringent standards. EPA set up the Federal Clean Air Act Advisory Committee Subcommittee on Ozone, Particulate Matter and Regional Haze Implementation. The charge to this group of almost 80 representatives of business, government, environmental groups, and academia was to develop recommendations to EPA on how to smoothly transition from the current requirements to new approaches. The challenge is to not lose the momentum that we have built as we have made substantial improvements in air quality with existing programs. But, as so many have stated, traditional regulatory programs are unlikely to be able to meet the challenges of new higher standards or even to solve the persistent problems we already have identified. New approaches must be used to harness economic forces to work in concert with regulatory efforts to address environmental protection. New ideas such as identifying areas of violation and areas of influence must be explored rather than just expecting each nonattainment area to solve its own problems in isolation from all else going on around its geographic boundaries. We must also explore ways to provide incentives for areas to expand monitoring, to do early planning, and to implement controls voluntarily before they become required. Current law has clearly outlined negative consequences for failure to plan or implement programs but does little to provide incentives for early or voluntary action.

In summary, there are five points regarding implementation of national air quality standards that I would like to leave with you. First, we do not believe that new national standards should be set until there is a firmer scientific basis. The recently released studies of health effects of ozone estimate fewer benefits from the proposed standard than previously thought. The particulate matter studies have raised as many questions as they have provided answers. Additional research is needed to target the cause of the particulate matter impacts on public health.

Second, if new standards are adopted, extensive new work will be needed to implement them and it appears likely that there will be little additional funding from EPA. States do not need another unfunded mandate.

Third, we should explore ways for air pollution planning to be a part of a city's urban planning whether or not new national standards are adopted that cause the city to be designated nonattainment. New approaches should build on voluntary action programs such as the Flexible Attainment Region approach being used in Tulsa, Longview/Marshall/Tyler, and Corpus Christi. Incentives for early planning, expanded monitoring, and voluntary or early reductions should be provided in EPA guidance and any new statutory revisions.

Fourth, adequate time should be provided to allow areas to plan, implement controls, and measure the results of those controls. The 5-year timeframes of §172 allow for planning and implementation but fail to recognize the need to monitor results

and that some areas have inadequate data bases upon which to begin their planning. Longer term planning cycles should include mid-course corrections so that new information is used to improve imprecise predictions of growth and emissions changes that will theoretically occur in the future.

Finally, adequate time must be provided to allow major trends such as those happening in the transportation sector to be a significant contributor to attaining national air quality goals. In order for the country to be able to afford all that is likely to be required to meet all of our air quality goals, we must allow time. Allowing time for market forces, technological development, and corporate economic planning will minimize costs of accomplishing the reductions and spread those costs as with other prudent investments in our future.

Thank you for the opportunity to present these comments. I would be pleased to respond to any questions you might have or to provide additional information that you would like to assist you in your review of these issues.

STATE OF TEXAS
OFFICE OF THE GOVERNOR

GEORGE W. BUSH
GOVERNOR

March 11, 1997

MAR 1 1 1997

The Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Ms. Browner:

In Texas, we are proud of our abundant natural resources and our stewardship of those resources. We are working to make our air and water cleaner.

Texans support this work, despite the costs, when the environmental and health improvements are clear. To assure continued public support for environmental programs, standards must be based on sound science and provide a clear benefit.

Texas' lead environmental agency, the Texas Natural Resource Conservation Commission, believes EPA's recent national air quality proposals do not provide Texans with this assurance. The TNRCC has informed me that a recent EPA-sponsored study found that the proposed national ozone standard may be more harmful to people in Houston than the existing standard, and that the proposed national fine particulate matter standard does not even have the endorsement of EPA's science advisory committee.

Texans want cleaner air, and we are continuing to work for that under the existing standards. We cannot support new national standards that are not based on sound science and do not provide clear benefits to Texans. Please reconsider again the merits of the proposed national air quality standards.

Sincerely,

GEORGE W. BUSH

GWB:PA/mc

cc: Texas Congressional Delegation
The Honorable Bob Bullock, Lieutenant Governor of Texas
The Honorable Pete Laney, Speaker of the Texas House of Representatives
Mr. Barry McBee, Chairman, Texas Natural Resource Conservation Commission

POST OFFICE BOX 12428 AUSTIN, TEXAS 78711 (512) 463-2000 (VOICE)/(512) 475-3165 (TDD)

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Dan Pearson, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

March 10, 1997

Office of Air and Radiation Docket and Information Center
Attn: EPA Docket No. A-95-58
U.S. Environmental Protection Agency
401 M Street SW
Washington, DC 20460

Re: Comments on the Proposed Revisions to the Ozone Standard

Dear Sir or Madam:

The Texas Natural Resource Conservation Commission (commission) would like to take this opportunity to comment on the proposed revisions to the Ozone Standards.

The commission has carefully reviewed all available information regarding the U.S. Environmental Protection Agency's (EPA) proposal to change the ozone standard and has concluded that there truly is no clear demarcation from a public health protectiveness perspective among the various levels and form for the standard under consideration. EPA's science advisory panel, the Clean Air Scientific Advisory Committee, stated that there is no "bright line" that distinguishes a level for an eight-hour standard between 0.07 parts per million (ppm) and 0.09 ppm, and a form between 1 and 5 expected exceedances. Now, EPA's own recent supplemental ozone exposure and health risk analyses show that there is no bright line in setting an averaging time either, and indeed calls into question the assumption that one particular averaging time, form, or level is appropriate for all areas in the nation. The commission is extremely concerned about these findings and in light of them recommends that the current one-hour standard be retained at this time, and that further study be initiated to determine the advisability of moving to an eight-hour standard for the entire nation. This is included as the commission's primary recommendation in Enclosure 1.

While the commission is not recommending a revision to the ozone standard at this time, should EPA do so, the commission submits for consideration a secondary recommendation in Enclosure 2.

P.O. Box 13087 • Austin, Texas 78711-3087 • 512/239-1000

The commission has held numerous meetings across the state to receive input from Texas citizens, small business, local governments, and industry. We received over 2000 comments, which demonstrates the interest that Texans have in these air quality standards and the impacts on their areas. We have forwarded these comments to you under separate cover.

Thank you for allowing Texas to comment on this important air quality issue. Please contact any of us or Mr. Herb Williams of our staff at (512) 239-4885 if you have any questions.

Respectfully,

Barry R. McBee	Ralph Marquez	John Baker
Chairman	Commissioner	Commissioner

BRM/EJ/ls

Enclosures

cc: The Honorable George W. Bush, Governor of Texas

Enclosure 1

Texas Natural Resource Conservation Commission's (commission) Primary Recommendation on the U.S. Environmental Protection Agency's (EPA) Proposed Revision to the Ozone Standard

The commission has carefully reviewed all available information about the EPA's proposal to change the ozone standard and has concluded that the standard setting process has not produced the "bright lines" we all desired. EPA's science advisory panel, the Clean Air Scientific Advisory Committee (CASAC), is comprised of several of the nations top medical and scientific experts. CASAC has stated that there is no bright line that distinguishes a level for an eight-hour standard between 0.07 parts per million (ppm) and 0.09 ppm, and a form of between 1 and 5 expected exceedances. Now, EPA's own recent supplemental ozone exposure and health risk analyses also show that there is no bright line in setting an averaging time, and indeed call into question the assumption that one particular averaging time, form, or level is appropriate for all areas in the nation.

On February 11, 1997, Harvey Richmond of EPA's Risk and Exposure Assessment Group issued a memorandum entitled **Supplemental Ozone Exposure and Health Risk Analyses**. This memo summarized recent findings of two EPA contracted documents. One is titled **A Probabilistic Assessment of Health Risks Associated with Short-Term Exposure to Tropospheric Ozone: A Supplement** by R.G. Whitfield of Argonne National Laboratory. The other is **Supplement to 'Estimation of Ozone Exposures Experienced by Outdoor Children in Nine Urban Areas Using a Probabilistic Version of NEM (April 1996)'** by Ted Johnson of TRJ Environmental Inc., et al. Both of these document updates were published in January, 1997. These documents were updated at EPA's request after the proposed revision to the primary ozone standard was published. These updates contain several refinements to modeling assumptions, including an analysis of the risk exposure associated with EPA's proposed level and form, and different rounding conventions, which were lacking in the original risk exposure analysis.

A review of these documents shows that for seven out of nine selected cities, the risks of both exposure to levels above the standard and "large" lung function decrements to children playing outdoors associated with EPA's proposal are less than that under the current standard. However, there are two notable exceptions to this trend. The risk exposure analysis for both Houston and Los Angeles projects that fewer children playing outdoors would be exposed to and suffer the effects of elevated ozone levels under the current one-hour standard than under EPA's proposal for an eight-hour standard.

At the very least, the commission believes that this study, which shows different public health outcomes for cities attaining an eight-hour standard, reveals that the science is not sufficiently conclusive at this time to make a decision on the appropriate averaging time for the primary standard. The commission is extremely concerned about these findings and in light of them

recommends that the current one-hour standard be retained at this time, and that further study be initiated to determine the advisability of moving to an eight-hour standard for the entire nation. For example, Houston and Los Angeles have design values for the one-hour standard that are 50 parts per billion or more higher than those of the next highest city, New York. They are also both warm, southern coastal cities, unlike the other study cities (except for Miami, which had an extremely low one-hour design value in the study). Other southern cities like Atlanta and Dallas were not studied, and cities currently in attainment that would be nonattainment under the proposed standard, like San Antonio, were also not studied. Therefore, it is not known whether the results for Houston and Los Angeles differ from those of the other cities because of their high ozone values or because of their geographic similarities. In order for the commission to support an eight-hour standard at this time, a fuller understanding of why Houston and Los Angeles experienced different outcomes than the other study cities would be necessary, as would an analysis of other major Texas cities and cities around the nation with similar geographic features.

The commission believes that these studies are absolutely essential to making a public health-based decision on the best science available. These studies cannot be completed in the time frame mandated by the courts for the particulate matter standard decision. Therefore, the commission recommends that EPA decouple the time lines for promulgation of the ozone and particulate matter proposals and delay promulgation of the ozone standard until further necessary studies have been performed.

The commission believes that cities such as Los Angeles and Houston may well be unique in their air pollution problems due to their source mix and prevailing meteorological conditions. If further study proves that they are, the commission believes that a "one-size-fits-all" approach to standard setting may not be prudent on a national basis, and that regions may have to choose an averaging time for an ozone standard that provides the greatest protection to the public. Of course, this choice would have to be based on sound science, and under no circumstances should areas be forced to comply with two national standards.

The commission believes that significant progress in understanding key scientific and public policy aspects of air pollution control has been made by the Federal Advisory Committee Act's Subcommittee on Ozone, Particulate Matter, and Regional Haze. The commission recommends that regardless of the ozone standard averaging time eventually promulgated by EPA, this vital work should continue and its results should be incorporated on the state implementation plan process, as appropriate.

Enclosure 2

Texas Natural Resource Conservation Commission's (commission) Secondary Recommendation on the U.S. Environmental Protection Agency's (EPA) Proposed Revision to the Ozone Standard

As stated in the preceding primary recommendation, due to numerous uncertainties that exist with regard to EPA's new ozone proposals including recent information that questions whether an eight-hour standard is more protective than the current standard in all areas of the nation, the commission believes that the EPA should retain a one-hour standard for now. However, if additional studies determine that an eight-hour standard is more protective than the one-hour standard in all areas of the country or if EPA chooses to go forward without additional studies, then the commission would support an eight-hour standard with the following comments as a secondary recommendation.

Level

The commission does not support the 0.08 parts per million (ppm) level proposed by the EPA, nor would it support a lower level. The commission supports a level of at least 0.09 ppm for the following reasons.

Both Clean Air Scientific Advisory Committee (CASAC) in its closure letter on the proposed primary ozone standard dated November 30, 1995 and EPA have determined that ozone may elicit a continuum of biological responses down to background levels. Therefore, it is not possible to select a level below which absolutely no effects are likely to occur. CASAC and EPA have agreed that in the absence of a "bright line" which clearly demonstrates a level at which exposure to ozone begins to cause adverse effects, the selection of a specific level is a policy judgment. The level proposed by EPA may result in five new areas in Texas not meeting the new standard, more than doubling the number of areas that do not meet the current ozone standard.

EPA lacks a scientific basis on which to choose between a 0.08 ppm and 0.09 ppm level for an eight-hour standard because there are no demonstrably greater health benefits to be gained at any specific point within the range of 0.07 ppm to 0.09 ppm. The commission believes that the following elements of good public policy should inform EPA's decision on the level of the standard.

Attainability. Is the proposed standard reasonably attainable? There are serious questions about the attainability of a proposed standard that approaches background concentrations. In its own Regulatory Impact Analysis (RIA), EPA states that:

> For some counties the analysis finds that the control measures identified in the cost analysis would not be sufficient to result in attainment of the alternatives by 2007...(t)here

are likely to be cases in which currently identifiable controls are not enough to reach attainment of the revised standard by 2007, which is the attainment date for certain nonattainment areas under the current standard.

Houston is one of the areas identified in the RIA for which not enough control measures could be identified for it to reach attainment of the proposed standard. If there are not enough control measures identifiable at any cost that would allow Houston to reach the proposed standard, for all practical purposes it is not attainable.

Reasonableness of costs incurred in light of benefit gained. EPA has argued that costs cannot play a role in the standard setting process based on judicial interpretation of the Federal Clean Air Act. The commission believes that this can be the case if a clear scientific determination of health effects could be demonstrated. However, neither EPA nor CASAC can determine a bright line which distinguishes any of the proposed standards as being significantly more protective of human health. Therefore the setting of the exact level has become a policy decision. Because it is a policy decision, a cost/benefit comparison of alternatives can and should properly be taken into consideration. Furthermore, costs to the public versus benefits is a vital public health consideration. All other public health and welfare decisions (e.g., building codes, immunization requirements, automobile safety requirements) are based on some determination that a certain level of control is necessary and therefore the costs should be borne by society. Conversely, some other level of control, while perhaps technically feasible, is too costly, and will therefore not be required.

EPA has stated in its fact sheets that the monetized net health benefits for the proposed new standards (ozone and particulate matter under 2.5 microns in diameter ($PM_{2.5}$) combined) are estimated to be between $76 billion to $134 billion dollars. However, a closer reading of EPA's back-up documentation (including the RIA), reveals that most of the monetized benefits are realized from attaining a $PM_{2.5}$ standard, and that there is actually a net monetary loss of up to $2 billion dollars incurred by attaining the proposed ozone standard. The commission believes that a full cost-benefit analysis should be performed and that the costs and benefits of the continued implementation of the Clean Air Act Amendments of 1990, the Ozone Transport Assessment Group recommendations, and the costs and benefits of the Interim Implementation Policy should be factored into the analysis. The commission believes that including these programs in the analysis will more accurately assess the true cost of all programs which will contribute to attainment of the proposed new standard.

Flexibility of decision-making in light of uncertain science. Before additional regulations and costs are placed on the public, the federal and state governments have an obligation to be sure that those costs are required for the protection of public health. If the standard is set at 0.08 ppm, many areas that currently do not violate the one-hour standard will not comply with the eight-hour standard. They will be required to begin expensive control programs. If later scientific evidence definitively shows a level of 0.09 ppm to be protective of health, these areas will have sustained a considerable economic loss for little or no benefit. However, if the level is set at 0.09 ppm, the

areas with demonstrated air pollution problems will be required to implement control strategies. If a level of 0.08 ppm is later scientifically demonstrated to be necessary for the protection of health, the reductions made by the areas that could not meet the 0.09 ppm standard will have helped them attain or make progress toward attainment of a 0.08 ppm level.

The commission believes that when all of these factors are taken into proper consideration, a level of at least 0.09 ppm would be the correct public health and public policy choice at this time for an eight-hour standard.

Form

The commission supports a form expressed as the three-year average of either the third, fourth, or fifth-highest maximum eight-hour average ozone concentration. The commission believes that such a form more accurately reflects the exposure of the population to ozone levels of concern. Also, this form is less subject to random perturbations caused by meteorological variations, like those seen in the years 1988 and 1995.

EPA has stated that for an eight-hour standard at a level of 0.09 ppm, it will only consider a form of the eight-hour average of the annual third-highest maximum eight-hour average ozone concentration. The commission believes this position is not justified by sound science. EPA stated, and CASAC concurred, that the form of the standard, as long as it is within the range of 1-5 expected exceedances (or an equivalent concentration-based form) does not provide a significant difference in the amount of risk exposure for the population at large (although all members of CASAC favored a multiple-exceedance based form of the standard). If EPA cannot identify a bright line which distinguishes between a form within the range of 1-5 expected exceedances, this too becomes a policy judgment. Therefore, the factors described above in the discussion about the level of the standard regarding attainability, cost/benefit impact analysis, and flexibility in light of uncertain science also pertain to the decision making on the selection of the form of an eight-hour standard. The commission believes that EPA should select a form which provides for maximum statistical stability.

Some studies indicate that some extremely sensitive individuals may be affected by shorter-duration levels that exceed the 0.09 ppm level. The commission believes that an expanded public notification system, based on improving techniques to predict elevated ozone levels in advance, which EPA discusses in the Pollution Standards Index (PSI) section of the proposal, will provide an adequate margin of safety to those extremely sensitive individuals considering the few times that such preventative measures would actually be required. The commission also supports investigation and analysis of monitors that frequently experience elevated levels of ozone. Given this additional margin of safety, the commission believes that the combination of this form and level of the standard will provide health protection to the public.

Spatial Averaging

The commission supports the concept of spatial averaging because it believes that spatial averaging can provide a better indicator of the population exposure actually experienced within the averaged area. Additionally, a spatially averaged form provides additional statistical stability and accuracy of monitored values. However, the commission believes that a complete analysis of whether the type of spatial averaging being considered by EPA is adequately protective of human health can only be done after further protocols are established to determine the method of conducting spatial averaging.

Furthermore, the commission shares EPA's concern that spatial averaging can only be done in areas that have an adequate monitoring network, and that developing a siting protocol will be difficult. However, the commission believes that spatial averaging, in conjunction with Urban Airshed and other modeling techniques, could provide an effective mechanism for redeployment of the ozone monitoring network and an incentive to states for this redeployment. The commission believes that an expanded public notification system, combined with improving techniques to predict elevated ozone levels in advance, could help provide an adequate margin of safety for extremely sensitive individuals. As stated above, the commission also supports investigation and analysis of the data from monitors and the area around them that frequently experience elevated levels of ozone.

Continuation of the One-hour Standard Until State Implementation Plan (SIP) Approval

If an eight-hour standard is promulgated, the commission does not support EPA's proposal to maintain the current one-hour standard until the SIP for the proposed new eight-hour standard is approved. More often than not, a long period of time passes between when the state has legal authority to implement control programs and when EPA approves a SIP. In many cases, this is of little concern, although it causes confusion in the mind of the public and the regulated community. In the case of the new standards, however, working under an interim policy based on a one-hour standard could impose a significant burden on states and the public, and hamper efforts to move toward attainment of an eight-hour standard.

All states have some mechanism for making control programs enforceable in their state, although each state's mechanism is slightly different. The commission believes that the one-hour standard should cease as soon as states have legal authority to implement and enforce control strategies to move toward attainment of the eight-hour standard and submit a SIP containing those strategies to EPA, rather than waiting for EPA approval of that SIP.

Communication of Public Health Information

The commission supports the continued use of the PSI and EPA's suggestion to revise the PSI to include an expanded warning system. The commission believes that this warning system, combined with the level and form described above, provides important public health information

to those extremely sensitive members of the public who might be affected by elevated levels of ozone. The commission also supports EPA's plans to increase the ability of forecasters to project an ozone episode a day in advance. The commission provides previous-day forecasting to several nonattainment and near nonattainment areas in Texas for their voluntary episodic ozone control programs, and would welcome the opportunity to work with EPA and other states and localities to improve forecasting and public notification efforts.

Conclusions on the Elements of the Secondary Standard

The commission supports setting the revised secondary standard identical to a proposed eight-hour standard of at least 0.09 ppm. The commission believes that controls to achieve an eight-hour standard of 0.09 ppm will reduce vegetation exposure during the growing season, and that without further scientific evidence, the secondary standard should not be more restrictive.

The commission does not support the "SUM06" seasonal exposure index for the secondary standard. The current monitoring network does not measure rural ozone levels, so estimates of counties that would not be attainment under the SUM06 are based on urban monitors and do not reflect the large rural areas between urban areas of Texas. Analysis performed by the state indicates that the form is highly unstable and is very dependent on large-scale meteorological fluctuations. For these reasons, the commission does not support a new secondary standard different from the primary standard.

Data Completeness

The commission supports with modification the proposed revision to Appendix H concerning data completeness. The commission believes that 90% data completeness for a three-year period and 75% for a single year are reasonable levels on which to base compliance with the standard, but only if hours when a monitor is undergoing a quality assurance check (such as a calibration check) are not counted for purposes of completeness. The commission recommends that surrounding hour data and historical trends be used to verify that ozone levels are low during these periods in order for those hours to be presumed complete. The commission further supports EPA's proposal to use meteorological data to provide an objective basis for determining if meteorological conditions were not conducive to high ozone levels for days with missing data. The commission has performed this type of analysis on several areas within Texas for numerous days, and finds this analysis, in conjunction with analysis of surrounding monitored values, to be a strong predictor of ozone levels.

Data Handling and Rounding Conventions

The commission believes that reporting ozone levels to three decimal places will eliminate public confusion about the level at which an exceedance actually occurs. However, EPA's protocols for ozone data monitoring call for calibration with a tolerance of plus or minus 15%. Acceptable modeling performance statistics are even greater. Therefore, it is inappropriate and inconsistent

to report data to such a level of precision that is beyond the capability of the current monitoring and modeling tools to capture.

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Dan Pearson, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

March 10, 1997

Office of Air and Radiation Docket and Information Center
Attn: EPA Docket No. A-95-54
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Re: Comments on the Proposed Revisions to the Particulate Matter (PM) Standard

Dear Sir or Madam:

The Texas Natural Resource Conservation Commission (commission) would like to take this opportunity to comment on the proposed revisions to the PM Standards.

The commission agrees with the U.S. Environmental Protection Agency's (EPA) Clean Air Scientific Advisory Committee's (CASAC) assessment that there is information indicating potential public health impacts from fine particulate matter ($PM_{2.5}$). However, there was no consensus among CASAC panel members as to the appropriate level for a new $PM_{2.5}$ standard. The divergent opinions expressed by CASAC members are reflective of many unanswered questions and large uncertainties. Such concerns include but are not limited to: 1) the influence of confounding variables, 2) measurement errors, 3) the existence of possible alternative explanations, 4) the lack of understanding of toxicological mechanisms, 5) exposure misclassification, and 6) the use of different models in the health studies. Based on the widely divergent views of the CASAC members, the lack of a sufficient data base to characterize or understand $PM_{2.5}$ levels, and the concerns listed above, the commission believes that it would not be prudent public policy to go forward with the setting of a new $PM_{2.5}$ standard at this time. The commission also supports the Western Governors Association's Resolution 96-025 urging the EPA to implement the targeted research program called for by CASAC to reduce the uncertainties associated with the current understanding of $PM_{2.5}$ before establishing new $PM_{2.5}$ standards, or revising the inhalable particulate matter standard.

The commission believes that the setting of a new $PM_{2.5}$ standard without resolution of the uncertainties associated with this issue could lead to misdirected control strategies. Therefore,

P.O. Box 13087 • Austin, Texas 78711-3087 • 512/239-1000

the commission cannot support the establishment of such a national standard at this time. In fact, to do so in the face of so many uncertainties and questions would not only be flawed public policy but may even be construed as an arbitrary and capricious action on EPA's part. The commission is unanimous in its recommendation against setting a national standard for $PM_{2.5}$ until further scientific and health information demonstrating the specific need for and level of such a standard is available.

The commission held numerous public meetings across the state to receive input from Texas citizens, small business, local governments, and industry. Over 2000 comments were received, demonstrating the interest Texans have in these air quality standards and the impacts on their areas. We have forwarded these comments to you under separate cover.

Thank you for allowing Texas to comment on this important air quality issue. Please contact any of us or Mr. Herb Williams of our staff at (512) 239-4885 if you have any questions.

Respectfully,

Barry R. McBee Chairman	Ralph Marquez Commissioner	John Baker Commissioner

BRM/JG/ls

cc: The Honorable George W. Bush, Governor of Texas

PREPARED STATEMENT OF PAUL KERKHOVEN, DIRECTOR OF ENVIRONMENTAL AFFAIRS, AMERICAN HIGHWAY USERS ALLIANCE

Mr. Chairman and members of the subcommittee, thank you for the invitation to appear before you today to present our views on how the U.S. Environmental Protection Agency's (EPA) proposed new ozone and particulate matter standards would impact transportation and specifically the Congestion Mitigation & Air Quality program.

I am Paul C. Kerkhoven, Director of Environmental Affairs at the American Highway Users Alliance. The Highway Users represent a broad cross-section of businesses and individuals who depend on safe and efficient highways to transport their families, customers, employees and products. We support the Clean Air Act and the health based scientifically sound standards that are its foundation as well as a strong Federal transportation policy and the prudent investment of scarce highway use taxes in those programs that enhance our economic productivity, improve roadway safety, and contribute to the enviable quality of life that Americans enjoy.

I will begin today by noting the significant clean air accomplishments of the transportation community. I will then briefly outline current environmental requirements applicable to transportation programs and offer our perspective on the implementation of the proposed new national ambient air quality standards. I shall finish with some specific comments on the Congestion Mitigation & Air Quality (CMAQ) program.

AIR QUALITY TRENDS

The transportation sector has played a major role in attaining the air quality goals realized by areas across the country. Since 1970, population in the U.S. has grown by 28 percent, production of goods and services has doubled, there are 60 percent percent more drivers driving 80 percent more vehicles 116 percent more miles. Yet, carbon monoxide emissions from highway vehicles have been reduced by one third and volatile organic carbon emissions have been cut in half.

Even today's cleaner reformulated gasoline for California is so effective it's almost like taking 3.5 million cars of the road—twice as many cars as are registered in Oregon. Today's cars have achieved a 95 percent reduction in tailpipe emissions since the 1960's. As a result, it would take 20 of today's new cars to produce as much tailpipe pollution as only one new car did 30 years ago. Automobile related air pollution is well on its way to being a thing of the past.

Those reduced motor vehicle emissions have been a major contributing factor in the air quality improvements realized nationwide. According to EPA data, ambient concentrations of the six major air pollutants have decreased almost 30 percent since 1970. As a result, every major city and urban area is making significant progress toward meeting the National Ambient Air Quality Standards. In fact, if we look at the most recent data only 40 some areas would be in violation of meeting the ozone standard. I expect reduced mobile source emissions to continue contributing to improved air quality well into the next century.

Yet, the EPA continues to downplay these results and argues that emissions from automobiles will begin to rise again by the year 2005 because of a projected steady increase in vehicle miles of travel. It should be noted that the agency has been projecting an increase in vehicle emissions since the early 1980's, and notice the results. The EPA therefore advocates strict policies to control the growth of vehicle miles traveled. It does this by enforcing transportation control measures (TCMs) that discourage automobile use and advocating higher funding for the CMAQ program to implement these TCMs.

A fundamental individual freedom, the freedom of mobility, is at stake whenever the government proposes to restrict Americans' ability to choose where, when, and how to travel. There may be times when such restrictions are necessary, but those decisions should be made by our elected representatives and not by the subterfuge of a bureaucratic rulemaking procedure. An additional 94 million people living in at least 520 counties will be subject to programs designed to limit the use of their motor vehicles if the proposed new air quality standards are approved. This estimate is based on EPA figures. Estimates by others suggest that the additional number of people affected could be significantly higher than 94 million.

Such constraints on motor vehicle use not only restrict personal mobility but they can be a serious obstacle to economic growth and productivity increases. In addition, transportation control measures have proven to be substantially less effective at reducing mobile source emissions than have technological solutions such as cleaner burning fuels and cleaner running cars. By every measure, these technological improvements have also been significantly more cost effective than programs intended to change travel behavior.

TRANSPORTATION AND AIR QUALITY

The aim of the Clean Air Act is to bring all U.S. areas into compliance with current air quality standards. The Clean Air Act also requires that State and local transportation improvement plans contribute to a reduction in pollutants. ISTEA complements the Clean Air Act by giving increased decisionmaking power to metropolitan planning organizations (MPO's) regarding the expenditure of Federal transportation dollars. ISTEA also gives these communities authority to use Federal highway funds for mass transit, air quality enhancements and other non-highway projects.

The Clean Air Act's largest challenge, however, is the requirement that State and regional transportation improvement plans in nonattainment and maintenance areas "conform" to State implementation plans. The State implementation plan includes an estimate of emissions from all sources including cars and trucks (mobile sources) and the amount of reductions necessary in each category to meet the standards. If actual vehicle emissions exceed the estimate in the State implementation plan, the transportation plan or the State implementation plan must be modified. If the State fails to modify its transportation plan or State implementation plan appropriately, Federal highway funds will be withheld. This is the "stick" that forces State and local officials to craft transportation plans which include the right mix of projects to reduce emissions.

PROPOSED STANDARDS AND TRANSPORTATION

The EPA proposed implementation policy which accompanies the new air quality proposal, states that the current conformity determination process will continue until State implementation plans that address the new standard are approved by the EPA. Depending on the standard finally chosen, we believe that at least 520 counties across the Nation could be placed in nonattainment status for at least one of the requirements proposed. We question whether the current model-intensive conformity process will still be meaningful with much larger non-attainment areas. For example, to make a conformity determination in rural areas will be a senseless and cumbersome exercise because in virtually all cases there are few, if any, transportation alternatives.

Changing direction in mid-course may significantly delay or run counter to efforts underway to assure reasonable further progress in attaining air quality standards. This will be extremely confusing for State and local officials and the general public.

The substantial expansion of non-attainment areas may well require an expansion of the transportation demand models that have experienced budget shortfalls and are still part of the learning curve for local, State and Federal officials involved in traffic data processing. The proposals will likely result in tighter emission budgets and make conformity an even more challenging process. The proposals do not address the cost and effectiveness of the transportation control measures and these may be the most costly elements of further emission reduction efforts.

The impact of highway funding sanctions could also affect much larger areas. We do not know if the inability of some areas to develop plans showing that they can attain the standard will lead to more frequent imposition of highway funding sanctions. Does the EPA intend to impose highway funding sanctions on the 8–20 residual nonattainment areas in its partial attainment scenario? Loss of highway funding, ironically, can delay highway projects that improve traffic flow and reduce emissions. Thus, the application of highway funding sanctions by the EPA can exacerbate air pollution problems that the sanctions are intended to help solve.

Transportation is a big part of the economic development equation. Highway improvements, including projects to expand capacity and reduce congestion, should be expedited, not burdened with new regulatory hoops.

TRANSPORTATION CONTROL MEASURES AND CMAQ

Congress established the Congestion Mitigation and Air Quality Improvement Program in ISTEA primarily to help State and local governments meet the cost of implementing the transportation control measures required by the Clean Air Act. CMAQ funds—$1 billion per year apportioned to the States from the Highway Trust Fund—can be used for all but two of the TCMs listed in the Clean Air Act, plus any TCMs included in a State implementation plan approved by the Environmental Protection Agency and any projects approved by both the Federal Highway Administration and the Federal Transit Administration in consultation with the EPA.

First and foremost, we oppose setting aside a billion dollars of highway funds each year exclusively to meet costs imposed on State and local governments by the Clean Air Act. Those air quality projects may or may not be a top transportation priority

in a given area. By setting aside highway funds exclusively for such projects, Congress places a higher priority on them than on other transportation projects, such as safety improvements or additional highway capacity needed for economic development. We think those decisions should be made by State and local officials who know best what their top local transportation priorities are.

A quick review of individual projects funded with CMAQ dollars over the first 4° years of ISTEA yields some examples that would raise questions about the wise use of highway taxes. To illustrate this point, I picked a few projects financed with CMAQ funds in States across the country. This is not intended to be an inclusive list. I could have added many more.

- $933,000—Purchase 210 bus radios at a total cost of $1,165,920. The Federal (CMAQ) share was $933,000 or $4,442 per radio
- $67,000—Develop a golf cart transportation program
- $5,890,000—Construct an esplanade and ferry pier
- $146,000—Supplement transit fare-box revenues

While I am not familiar with any of these individual projects, I don't doubt that they have benefited, and are appreciated by, certain local citizen groups. One wonders, however, how they compare in priority with any of the myriad safety or highway capacity needs faced by State and local officials. We won't ever know the answer to that question because those officials weren't allowed to spend CMAQ dollars on safety or capacity improvements.

Again, Mr. Chairman, many of these projects may be a high priority and have a salutary impact on the local economy. Unfortunately, we cannot truly gauge the priority of these or other CMAQ-funded projects relative to traditional road improvements because State and local officials are not allowed to weigh the CMAQ-eligible projects against other local projects to improve mobility or safety. ISTEA doesn't give them a choice. They must either spend or lose their CMAQ funds on the limited array of EPA-approved projects.

Mr. Chairman, the Highway Users supports efforts to eliminate the separate CMAQ funding category. Instead of the current CMAQ set-aside, we would make air quality and congestion mitigation projects eligible for funding under a streamlined Surface Transportation Program (STP).

We do not support the assertion that State transportation officials will not consider or implement TCM's in their transportation plans if they do not have a specific set-aside for them. It is not the CMAQ program that drives these requirements. The Clean Air Act mandates that State transportation officials give priority consideration to TCM's in their clean air plans, and if attainment goals are not reached, the State faces highway funding sanctions. What greater incentive is there? America's motorists should be able to count on their highway taxes being used for road improvements, and State and local transportation officials should have greater authority to set their own transportation priorities.

CMAQ AND NEXTEA

We have several concerns with the CMAQ proposals contained in the Administration's "National Economic Crossroads Transportation Efficiency Act" (NEXTEA), recently introduced by Senators Chafee and Moynihan. We do not support the "Hold Harmless" provision for CMAQ funding, nor do we support the proposal that when a State submits its new SIP the CMAQ funding increase is triggered. Both provisions expend CMAQ funding at the expense of the more flexible STP account.

As an alternative to the set-aside, it seems quite logical for the Congress to repeal CMAQ in its entirety and allow States to utilize any and all funding from the STP program to achieve the Clean Air Act goals. More of the areas that could be facing nonconformity determinations would be able to tailor their transportation programs to meet their specific circumstances.

If the Congress chooses to retain a separate CMAQ account, we do support the Administration's proposal to make eligible for CMAQ funding two of the TCMs that show great promise for improving air quality: the reduction of vehicle emission during periods of cold-start conditions, and measures that encourage the owners of pre 1980 model year high-emitting cars and light-duty trucks to voluntarily remove them from the road. These TCMs are listed in the Clean Air Act but were excluded from the list of TCMs made eligible for CMAQ funding in ISTEA.

In addition, "congestion mitigation" projects should be eligible for any continued CMAQ program. Most projects currently funded with CMAQ dollars are air quality projects. Congestion mitigation projects, such as those that increase the capacity for single occupant vehicles in ozone and CO non attainment areas, are not currently eligible for CMAQ funds. For example, freeway interchanges with insufficient merge lanes or other capacity problems are frequently traffic choke points. Yet, improve-

ments to those intersections that would ease the flow of traffic are generally ineligible for CMAQ funding because they create additional capacity for single occupant vehicles. Congress should correct this problem to help alleviate congestion in any renewed CMAQ program.

CONCLUSION

Mr. Chairman, improving air quality is an important national goal and the transportation sector of our economy certainly has a role to play. Our central points are as follows: current and emerging technologies will ensure the continuing decline of mobile source emissions without the new air quality standards. We should not burden vast areas of the country with new regulatory hoops the proposed standard changes will create. The transportation control measures needed to meet the new standards could cause significant economic hardship and will—echoing comments of the U.S. Department of Transportation—require lifestyle changes by a significant part of the U.S. population.

Finally, the Clean Air Act gives transportation officials strong incentives to make air quality projects a top priority. We urge Congress to give those officials a truly flexible Surface Transportation Program account that will allow them to weigh all their local transportation needs, including air quality improvements, when establishing funding priorities.

I appreciate the opportunity to have presented the Highway Users' views on the air quality standards proposals and their impact on transportation and the CMAQ program. I would be pleased to answer any questions that you might have.

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Regulatory Analysis Program
Center for Study of Public Choice
George Mason University

Comments on the Proposed

National Ambient Air Quality Standards for Ozone

and

Particulate Matter

Submitted to:

U.S. Environmental Protection Agency

March 12, 1997

REGULATORY ANALYSIS PROGRAM

Center for Study of Public Choice
George Mason University

March 12, 1997

Honorable Carol M. Browner, Administrator
U. S. Environmental Protection Agency
401 M St., S. W.
Washington, D. C. 20460

Dear Administrator Browner,

The Environmental Protection Agency's proposals to change the National Ambient Air Quality Standards for ozone and particulate matter raise a number of important issues on which EPA has requested comment. The attached analyses were prepared for the Regulatory Analysis Program in response to EPA's request for comments.

The Regulatory Analysis Program of the Center for Study of Public Choice at George Mason University in Fairfax, Virginia, is dedicated to advancing knowledge of regulations and their impact. As part of its mission, this program produces careful and independent analyses of agency rulemaking proposals from the perspective of the public interest. Our objective is to provide agencies with analyses that reflect the interest of the average citizen.

The attached studies were prepared for the Regulatory Analysis Program in accordance with our objective of providing careful and unbiased analyses of agencies' proposed regulations. These analyses provide an assessment of EPA's proposals, the science and evidence concerning the proposals, and the regulatory impact analyses EPA conducted to accompany the proposals. In addition, we have prepared additional analysis, information, and quantitative estimates in certain areas.

Both analyses suggest that EPA's December 1996 proposals do not offer a solid case for adopting more stringent ozone and particulate matter standards. EPA's science advisors do not endorse either proposal on public health grounds. Furthermore, the costs of the proposed standards are huge.

In the case of ozone, more than 98% of the health benefits EPA claims the proposed standard will produce is based on one study that appears not to have been reviewed by EPA's science advisory committee (CASAC). Furthermore, EPA has

neglected to consider the harm that will be caused by an increase in the public's exposure to ultraviolet rays as a result of a decrease in ozone and particulate matter. The benefits of ozone's screening effect should be considered along with its negative effects. Our analysis provides estimates of the impact of increased exposure to ultraviolet radiation on health and welfare.

In the case of particulate matter, EPA's science advisors could not agree on EPA's proposal. Furthermore, it is not clear whether EPA has drawn the correct inferences from the studies relating particulates and health effects, due to questions about the effect of other "confounding" variables such as humidity.

The costs of both proposals are enormous. Even EPA's estimates of *partial* compliance with the proposed standards are large -- between $600 million and $6.3 billion annually for ozone and $6.3 billion annually for particulate matter. In the case of ozone, EPA's own regulatory analysis estimates the costs of the proposed standard to greatly exceed the benefits. Our own analyses, presented in the attached documents, suggest much higher costs -- between $54 billion and $328 billion per year for ozone and $55 billion per year for fine particles. While EPA does not consider cost in formulating its proposals, these estimates are informative, especially when one considers the evidence correlating lower incomes to poorer health. To the extent that these proposals reduce economic growth, income and the health of individuals will suffer even more.

Our analysis leads us to conclude that EPA should not proceed with promulgation of the proposed standards for ozone or for particulate matter. Health and welfare will in all likelihood be harmed rather than helped if these proposals are implemented. Further research on questions raised about fine particles is needed. For ozone, EPA's own estimates indicate that the costs of the current standard exceeds the health benefits. Perhaps further study on the current standard and its form, including ultraviolet radiation effects, could be done to devise better ways to reduce costs and improve health benefits. Both study programs can be pursued while levels of pollution continue to decline under the current standards.

Finally, we believe EPA should undertake additional analysis, not only to improve the quality of its rulemaking, but also to fulfill other requirements. Specifically, the following laws and executive order require such analyses. (1) The Unfunded Mandates Reform Act of 1995 (UMRA) requires federal agencies to assess the effects of their regulatory actions on state, local, and tribal governments and the private sector, and conduct cost-benefit analyses of regulations imposing costs of $100 million or more in a year. (2) The Regulatory Flexibility Act (RFA) requires federal agencies to examine the impact of proposed regulations on small entities. Agencies must either certify that a rule will not have a significant economic impact on a substantial number of small entities, or evaluate the alternatives that would minimize such an impact. (3) Executive Order 12866

requires federal agencies to conduct a regulatory impact analysis of significant regulatory actions.

EPA interprets Sections 108 and 109 of the Clean Air Act to prohibit the consideration of cost-effectiveness or economic feasibility in setting ambient air quality standards. EPA uses this view to the determine that provisions of UMRA do not apply. However, even if EPA is correct in its view that the Clean Air Act dominates the provisions of UMRA and precludes consideration of costs in its setting of standards, the Clean Air Act does not prevent EPA from estimating costs or assessing a regulation's effects. Just as EPA estimated costs in its regulatory impact analysis because the analysis was required by Executive Order 12866, EPA could also perform the analysis as required by UMRA.

EPA believes that its proposals for ozone and particulate matter will not have a significant economic impact on a substantial number of small entities because it merely sets a standard, while the implementing regulations will impose costs. It is unrealistic to separate the two, since implementing regulations impose costs as a direct result of the standard setting. Therefore, the standards proposed in these rules will, if adopted, impose large costs on a substantial number of small entities and EPA must comply with the requirements of the Regulatory Flexibility Act.

The Regulatory Analysis Program appreciates the opportunity to comment on EPA's proposals. Please place these comments on ozone and particulate matter into the record of both rulemaking proceedings (61 FR 65716 - Docket No. A-95-58 and 61 FR 65638 - Docket No. A-95-54, respectively). We hope that consideration of these comments will enhance the quality of EPA's proposals.

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Comments on the
U.S. Environmental Protection Agency's
Proposed

National Ambient Air Quality Standard for Ozone

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Comments Of The Regulatory Analysis Program on EPA's Proposed Ozone NAAQS

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The Regulatory Analysis Program offers the following conclusions and recommendations regarding EPA's proposed revision to the ozone National Ambient Air Quality Standard (NAAQS) and the accompanying Regulatory Impact Analysis (RIA).

A. The proposal will not improve public health and welfare.

EPA interprets the Clean Air Act to prohibit the consideration of costs in setting NAAQS. Even if one were to accept EPA's interpretation of its statute, EPA appears to have ignored important public health and welfare considerations.

There is little scientific basis for the selection of the standard, and the health and welfare benefits attributed to the proposal are small and highly uncertain. Moreover, EPA has chosen not to consider important risk information relevant to public health and welfare, arguing that the statute only allows it to consider the *negative* impacts of chemicals, not their *positive* impacts.

As a result, EPA's proposal may *harm* public health and welfare, regardless of cost. For example, the potential for a change in the ozone standard to increase people's exposure to ultraviolet radiation raises serious questions about the net health and welfare effects of this proposal. Taking into consideration the beneficial screening effects of ozone on ultraviolet radiation, we estimate that the impact of attaining the proposed standard would be to *increase health risks by over $280 million per year*. This is particularly disturbing in light of the enormous costs full attainment of this rule would impose on every aspect of our lives.

When the costs of the proposal are considered, the negative impact on public health is even more dramatic. If, as recent studies suggest, poverty is a more important risk factor for asthma than air quality, the rule may well increase the very disease it is purportedly targeted at improving. Moreover, studies linking income and mortality suggest that the cost of this proposal would, by lowering incomes alone, result in an increase in 4,250 to 5,667 deaths per year.

EPA has a responsibility for setting NAAQS that protect public health and welfare. To fulfill that responsibility it cannot ignore important health and welfare effects which can be readily, and reliably, quantified.

B. EPA's regulatory impact analysis does not provide an adequate basis for making a sound policy judgment.

According to EPA's own RIA, the costs of the proposal will exceed the benefits. Furthermore, questionable assumptions and serious omissions in the RIA lead to an understatement of costs. EPA admits that "aggregate total costs underestimate the true cost of each alternative to such an extent that the metric's reliability must be limited." EPA estimates the cost of only partially complying with the current and proposed standards. EPA does not include the costs of regional controls in its estimates of either the current or proposed ozone NAAQS. EPA also assumes that areas that can achieve ozone concentrations that are only 64 percent of the standard will incur no costs. As a result of these deficiencies, our analysis suggests that EPA's cost estimates reflect less than 5 percent of the true full costs of attainment.

Modeling, exposure, and valuation constraints make EPA's benefit estimates very uncertain. CASAC observed that due to the compounded uncertainties in the approach to estimating welfare effects, "small differences in benefits may have no significance..." EPA places its best (i.e., most likely) estimate of the incremental health benefits of the proposed standard is at the low end of its range, between $11 million and $108 million.

According to EPA, more than 98 percent of its total estimated health benefits come from reduced mortality, not the other health benefits EPA relies on to support its proposal. However, this estimate of reduced fatalities is based on a single study that was not discussed in the criteria document or staff paper, and thus not reviewed by EPA's science advisory committee (CASAC).

C. The costs of the proposed standard are strikingly high.

Even after imposition of all feasible control measures, EPA anticipates a large degree of nonattainment. Without any change in the current NAAQS, EPA estimates that between 39 million and 57 million people will live in non-attainment areas for the foreseeable future. EPA expects an additional 14 million to 32 million people would live in non-attainment areas under the proposed revised standard.

EPA estimates that partial attainment of the standard will cost billions of dollars each year and impose *costs in excess of benefits* on Americans of between $1.1 billion and $6.2 billion each year. These net costs are over and above EPA's estimates of the annual net costs of partially complying with the existing standard, which are also considerable—EPA estimates the costs of partially meeting the current standard will exceed benefits by between $400 million and $2.2 billion per year.

The full costs of meeting this standard would be orders of magnitude higher than EPA's estimated costs of partial attainment. Our analysis suggests that the full cost of attaining the current standard will be between $22 billion and $53 billion per year. We estimate that the proposed standards will impose additional costs in the range of $54 billion to $328 billion per year (1990 dollars).

D. Recommendations

Based on our review and analysis of EPA's proposal, we offer the following recommendations.

1. EPA should not proceed with promulgation of the proposed standard.

In light of EPA's science panel's conclusion that the proposed standard (level and number of exceedances) is not significantly more protective of public health than the alternatives examined, and the very real concern that implementation of this rule will actually harm public health and welfare, EPA should not proceed with its promulgation.

There may be adequate basis for changing the *averaging time* and *form* of the standard. However, as EPA's own analysis suggests that the current *level* of the standard already imposes social costs (both in terms of health and welfare) that exceed its benefits, EPA should not select a level and number of exceedances that is more stringent than the current standard.

2. More effective alternatives are available for addressing the potential ill effects of ozone.

Non-regulatory approaches are available to achieve the public health benefits targeted by this rule. As CASAC recommended in its November 30, 1995 closure letter on the primary standard, public health advisories and other targeted approaches may be an effective alternative to standard setting.

> Because there is no apparent threshold for responses and no "bright line" in the risk assessment, a number of panel members recommended that an expanded air pollution warning system be initiated so that sensitive individuals can take appropriate "exposure avoidance" behavior. Since many areas of the country already have an infrastructure in place to designate "ozone action days" when voluntary emission reduction measures are put in place, this idea may be fairly easy to implement.

Furthermore, research and education are more likely to target what some public health experts regard as a more important factor behind the increasing incidence of asthma during a period in which ozone (and other pollutants) are declining—poverty and poor living conditions.

I INTRODUCTION

Ozone is a gas that occurs naturally in the earth's troposphere and stratosphere. It is also created when sunlight reacts with nitrogen oxides (NOx), and volatile organic compounds (VOCs). Tropospheric (ground-level) ozone is the primary constituent of urban smog.

Ozone levels are heavily influenced from year to year by meteorological conditions. EPA observes that the lowest national mean level of ozone was recorded in 1992, and the highest in 1988. After adjusting for meteorological effects, however, the year to year trend shows a continued improvement in ozone concentrations of about one percent a year.[1]

Ozone is associated with respiratory problems, particularly in sensitive individuals. It is also credited with reducing the harmful effects of ultraviolet rays. Because it "may reasonably be anticipated to endanger public health and welfare," ozone has been identified under the Clean Air Act as a "criteria pollutant." The U.S. Environmental Protection Agency (EPA) must periodically review and, as necessary, revise its National Ambient Air Quality Standards (NAAQS) for criteria pollutants.

The CAA charges EPA with setting NAAQS that protect public health and welfare. In these comments,[2] we examine whether EPA's December 1996 proposed revision to the ozone NAAQS meets this mandate.

The rest of our comments are organized as follows.

Section II **Review of EPA's Proposal**

We review EPA's statutory obligations, its interpretation of those obligations, and the factors EPA relied on in making its policy judgment regarding the appropriate standard to protect public health and welfare. This review suggests that because EPA bases its policy judgment on a narrow set of criteria, the resulting rule is likely to result in public health and welfare outcomes contrary to EPA's expressed intent.

Section III **Review of EPA's Regulatory Analysis**

EPA's own regulatory analysis, summarized in the first part of this section, concludes that the costs of implementing the proposed standard will exceed

[1] U.S. EPA *National Air Quality and Emissions Trends Report, 1995.*

[2] These comments were prepared by Susan E. Dudley, Vice President and Director of Environmental Analysis at Economists Incorporated with support from the Regulatory Analysis Program at the Center for Study of Public Choice at George Mason University.

the benefits. In the second part of this section, we identify major flaws in EPA's analysis and present revised estimates of the benefits and costs of the proposal based on our own analysis.

Appendix A **Uncertainties in EPA's Analysis**

Due to the considerable uncertainty in the science associated with both ozone modeling and the health and welfare effects of different ozone levels, EPA's analysis necessarily involves numerous assumptions. This appendix reviews key uncertainties and assumptions.

Appendix B **Ozone's Impact on Ultraviolet Radiation**

Ozone in the troposphere, like ozone in the stratosphere, has the beneficial effect of screening ultraviolet radiation, which is known to have various health and welfare effects including melanoma and non-melanoma skin cancer, cataracts, and crop and fishery damage. This appendix presents our analysis of the harmful public health and welfare impact that would be caused by the reduction in tropospheric ozone if this rule is implemented.

Appendix C **The Full Costs of Attainment**

EPA's estimates reflect only the cost of partial attainment. In this appendix, we present our analysis of the full costs based (1) on assumptions EPA uses in its analysis, and (2) on our revisions to EPA's estimates.

Appendix D **Control Measures to Achieve Partial Attainment**

This appendix reproduces EPA's Table C-1 from Appendix C of its Ozone NAAQS RIA. The table lists the control measures EPA expects to be used to achieve partial compliance with the current and proposed standards.

II REVIEW OF EPA'S PROPOSAL

In this section we review the statutory basis for setting national ambient air quality standards (NAAQS), EPA's interpretation of its statutory obligations, and the criteria the agency considered in proposing to revise the ozone NAAQS. The following key conclusions emerge from this review.

Without scientific evidence that any of the analyzed alternatives is more protective of health and welfare than another, the selection of a standard reflects a policy judgment. EPA's Clean Air Scientific Advisory Committee (CASAC), a legislatively established body of independent experts that provides advice to EPA on scientific issues, agrees that the form and averaging period on which the current standard is based could be improved. However, CASAC concluded that "there is no 'bright line' which distinguishes any of the proposed standards (either the level or the number of allowable exceedances) as being significantly more protective of public health." Moreover, **the majority of members on the panel who expressed an opinion preferred a level of the standard that is less stringent than that proposed by EPA**. As ozone exhibits no threshold concentration level below which biological responses are not observed, EPA and its legal and scientific advisors agree that policy judgments must drive the selection of the standard. In other words, EPA must make a risk management decision.

By narrowly focusing its policy judgment, EPA's selection of the proposed level and form of the standard is likely to result in perverse and unintended public health and welfare outcomes. At best, EPA's own analysis suggests that the proposed standard will result in (1) very small changes in health status for a very small population of sensitive individuals, and (2) small reductions in crop damage. It is more likely that the proposal will actually harm public health and welfare. This is true even without considering the huge costs of the proposal, which clearly could be used in other ways to promote health and welfare more effectively.

The remainder of this section discusses these issues in greater depth. In section A we summarize the requirements of the Clean Air Act (CAA). In section B we summarize EPA's proposal. We examine and comment on EPA's decision regarding the primary standard in section C, and the secondary standard in section D. We present our conclusions in section E.

A. Summary of Statutory Requirements

Sections 108 and 109 of the CAA require EPA to review periodically the air quality criteria and national ambient air quality standards (NAAQS) for criteria pollutants, including ozone (O_3). The CAA directs EPA to set both a

primary standard (to protect the public health), and secondary standard (to protect public welfare).

The CAA defines a **primary standard** as one "the attainment and maintenance of which, in the judgment of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health."[1]

The Act states that a **secondary standard** must "specify a level of air quality the attainment and maintenance of which, in the judgment of the Administrator, based on [the] criteria, [are] requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air."[2] Welfare effects include "effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility and climate, damage to and deterioration of property, and hazards to transportation, as well as effects on economic values and on personal comfort and well-being."[3]

B. Summary of EPA's Proposal

EPA proposes changes in the primary and secondary NAAQS, as summarized below.

1. Primary Standard

EPA's November 1996 Federal Register notice (61 FR. 65716) proposes changes to the averaging period, level, and form of its primary (i.e., health based) ozone NAAQS that would:

- Base attainment of the standard on 8-hour, rather than 1-hour averages.
- Tighten the current "level" of the standard to 0.08 parts per million (ppm) averaged over eight hours from 0.12 ppm averaged over one hour.
- Change the test for attainment (which EPA refers to as the "form") of the standard to a 3-year average of the third-highest ozone concentration (averaged over 8 hours). (The current test of attainment is whether a site exceeds the 1-hour standard on average no more than once per year, averaged over three years.)

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[1] CAA Section 109(b)(1) (42 U.S.C. 7409)
[2] CAA Section 109(b)(2) (42 U.S.C. 7409)
[3] CAA Section 302(h) (42 U.S.C. 7602(h))

Under the proposal, an area would be in attainment with the standard when the average of the third-highest daily ozone concentration[4] over the last three years is less than or equal to 0.08 ppm. In addition to the proposed standard, EPA requests public comment on two alternative *levels* for the primary standard: a less stringent 0.09 ppm, and a more stringent 0.07 ppm.[5] EPA also solicits comment on the appropriate concentration-based *form* (loosely referred to as the number of exceedances).

These comments focus primarily on EPA's proposed change in the *level* of the standard. The rationale for the change in *averaging time* (that longer averages better reflect actual exposure to ozone) appears reasonable, and is supported by EPA's science advisors. EPA's rationale for changing the *form* of the standard (that the current form, which allows one exceedance per year, is unstable because areas flip-flop between attainment/nonattainment status) is also reasonable, though EPA's choice of the third-highest maximum concentration is not supported by science.

2. Secondary Standard

EPA proposes to revise the secondary standard so that it will be identical to the proposed primary standard. (The current secondary standard is set identical to the existing 0.12 ppm 1-hour primary standard.) EPA requests comment on an alternative "seasonal standard expressed as a sum of hourly O_3 concentrations greater than or equal to 0.06 ppm, cumulated over 12 hours per day during the consecutive 3-month period of maximum concentrations during the O_3 monitoring season, set at a level of 25 ppm-hour."[6] This alternative form does not appear to be well-supported. Our comments on the secondary standard address both the *level* and the proposed alternative *form*.

The next two sections discuss the factors EPA's considered in setting the primary and secondary standards, and the potential impact of these standards on public health and welfare.

C. Evaluation of EPA's Decision Regarding the Primary Standard

In interpreting the statutory language regarding the primary or health-based standard, EPA recognizes:

> The Act does not require the Administrator to establish a primary NAAQS at a zero-risk level but rather at a level that

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[4] These are daily maximum 8-hour average ozone concentrations.
[5] EPA considers the current 0.12 ppm 1-hour standard equivalent to a 0.09 ppm 8-hour standard.
[6] Preamble, I(A)

> reduces risk sufficiently so as to protect public health with an adequate margin of safety.[7]

EPA's panel of science advisors, CASAC, emphasizes in its communications with EPA that no scientific basis exists for determining a threshold level that is protective of public health. Without a bright line, EPA admits that its selection of a level and number of allowed exceedances for the 8-hour standard is a **policy judgment**, as opposed to a purely scientific judgment, that must reflect an assessment of risk.

Yet, EPA constrains this policy judgment to a narrow range of considerations. "As interpreted by the Agency and the courts, this decision is a *health-based* decision that specifically is *not* to be based on cost or other economic considerations."[8]

This approach to interpreting EPA's responsibility for protecting public health prevents the agency from considering factors that would normally be considered important in any policy judgment. As discussed in Section III below, the estimated benefits and costs of this proposal raise serious questions about its effectiveness at protecting public health.

Even if one were to accept EPA's interpretation of what may be considered in setting the primary standard, EPA appears to have ignored important public health considerations. The scientific basis for the selection of the standard is far from definitive, and the health risk benefits attributed to the proposal are small and highly uncertain. Moreover, EPA has chosen not to consider important risk information relevant to public health. As a result, the proposed primary standard may well result in policy outcomes contrary to EPA's expressed intent.

1. The proposal lacks strong scientific support.

EPA bases the revised level of the standard on evidence that ozone-induced health effects may occur at levels lower than the current standard. Yet this evidence is weak, and the majority of EPA's science advisors preferred levels that are less stringent than that proposed by EPA.

a) Evidence of health effects is weak.

EPA bases its selection of the 0.08 standard on the following evidence of ozone-related effects:

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[7] Preamble, I(A)
[8] RIA Executive Summary

- **Human clinical studies** show associations between exposure to ozone concentrations of 0.08 ppm over 6- to 8-hour periods and "lung function decrements, respiratory symptoms (e.g., cough, pain on deep inspiration), nonspecific bronchial responsiveness, and biochemical indicators of pulmonary inflammation."[9] EPA recognizes that the observed **clinical effects** are transient, reversible, and generally asymptomatic (i.e., do not present any symptoms of disease or discomfort). However, it concludes that "while group mean responses in clinical studies at the lowest exposure level tested of 0.08 ppm are typically small or mild in nature, responses of some extremely sensitive individuals are sufficiently severe and extended in duration to be considered adverse."

- **Epidemiological studies** suggest an association between high ozone concentrations and excess hospital admissions. EPA considers this epidemiological association to be a public health problem warranting a tighter standard, but it recognizes the effect of the proposal on respiratory hospital admissions will be very small (on the order two percent or less).[10]

- **Long-term laboratory animal studies** suggest changes in lung biochemistry and structure. However, these studies *do not show effects on lung function* as a result of those changes, even though the animals were exposed continuously over many months to much higher doses of ozone than would occur under current standards. Moreover, EPA acknowledges that it is "unclear whether long-term exposures to ambient O_3 levels result in similar chronic health effects in humans."[11]

b) The proposed level lacks support from scientific advisors.

To support its proposal, EPA focuses on the consensus reached by CASAC regarding the scientific basis for the proposed rule. The preamble to the proposal states:

> "It was the consensus of the Panel that although our understanding of the health effects of ozone is far from

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[9] Preamble, II(C)(2)

[10] EPA states "that the O_3-induced excess hospital admissions represent a relatively small fraction of the overall respiratory-related hospital admissions for asthmatics over the seven month O_3 season. Based on an estimated 15,000 admissions per year during the O_3 season, the reduction in hospital admissions for asthmatics for any respiratory-related reason in going from "as is" air quality to attaining a 0.08 ppm, 8-hour, 1-expected exceedance standard is about 2%. Similarly, the reduction from attaining the current 1-hour standard to attaining a 0.08 ppm, 8-hour, 1-expected exceedance standard represents about a 0.6% decrease in total respiratory admissions for asthmatics due to all causes." Preamble, II(B)(2)(b)

[11] Preamble, II(C)(2)

> complete, the document provides an adequate scientific basis for making regulatory decisions concerning a primary ozone standard."

However, a review of CASAC closure documents reveals that the panel was more circumspect. **While the panel agreed that EPA had adequate bases for making a regulatory decision, it did not endorse the decision EPA made. In fact, most panel members who expressed an opinion on the level of the standard preferred one equivalent to the current standard.** CASAC also emphasized the uncertainties in the risk and exposure information on which the proposal is based, "because of the myriad of assumptions that are made to estimate population exposure and risk, large uncertainties exist in these estimates."[12]

CASAC also highlighted the small differences in health protection between the current standard and the proposed alternatives. It concluded that

> there is no 'bright line' which distinguishes any of the proposed standards (either the level or the number of allowable exceedances) as being significantly more protective of public health. For example, the differences in the percent of outdoor children ... responding between the present standard and the most stringent proposal (8H1EX at 0.07 ppm) are small and their ranges overlap for all health endpoints. ... [W]hen ozone-aggravated asthma admissions are compared to total asthma admissions, the differences between the various options are small.[13]

Furthermore, the majority of CASAC preferred a less stringent standard than that proposed by EPA:

> Of the ten panel members who expressed their opinions, all ten favored multiple allowable exceedences, three favored a level of 0.08 ppm, one favored the mid to upper range (0.08 - 0.09 ppm), three favored the upper range (0.09 ppm), one favored a 0.09 - 0.10 ppm range with health advisories issued when the 8-hour ozone concentration was forecasted to exceed 0.07 ppm, and two just endorsed the range presented by the Agency as appropriate and stated that the selection should be a policy decision.[14]

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[12] CASAC letter to Carol Browner RE: Closure on the Primary Standard Portion of the Staff Paper for Ozone
[13] Ibid.
[14] Ibid.

In summary, while EPA stresses that its decision is purely a public health decision, scientific experts stress that "there is no 'bright line' which distinguishes any of the proposed standards (either the level or the number of allowable exceedances) as being significantly more protective of public health." In other words, the panel did not find the proposed standard to be significantly more protective of public health than the existing standard.

2. EPA's selection criteria is flawed.

The preamble suggests that after examining the scientific evidence regarding the health effects of ozone, the Administrator put the public health effects associated with tropospheric ozone "into a broader public health perspective."[15]

> In deciding between the 0.08 ppm and 0.09 ppm alternatives, the Administrator took into account several factors including: 1) estimates of risk, in terms of the percentage of children likely to experience respiratory symptoms and decreases in lung function of concern; 2) estimates of exposures to the lowest concentration at which other, more uncertain effects have been observed; and 3) the body of health effects evidence as a whole.[16]

Yet, the factors actually considered by EPA in selecting the proposed 0.08 ppm level of the standard actually reflect a narrow set of public health considerations. **When considered in a broader context, it is not at all clear that overall public health would improve significantly as a result of implementing this rule. In fact, there is evidence that this proposal would actually have a detrimental effect on public health.**

The 1997 final report of the Presidential/Congressional Commission on Risk Assessment and Risk Management points out that "many risk management failures can be traced to ... not considering risks in their broader context" and that traditionally "most risk management has occurred in an artificially narrow context" without regard for other risks.[17] The three factors identified in the preamble as the Administrator's considerations in selecting the 0.08 ppm standard illustrate this problem.

For the first factor—estimates of risk to outdoor children—EPA observes a "continuum of risk reduction" in going from 0.09 ppm to 0.08 ppm. This observation is based on Table 1 of the preamble, which suggests that the

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[15] Preamble, II(C)(2)
[16] Preamble, II(C)(2)
[17] The Presidential/Congressional Commission on Risk Assessment and Risk Management, *Framework for Environmental Health Risk Management, Final Report*, Volume 1, January 1997, pp. 5, 9.

percent of "outdoor children"[18] experiencing moderate or severe pain on deep inhalation would decline from 1.3 percent or 0.9 percent to 0.8 percent or 0.6 percent, depending on the form of the 0.08 ppm standard. As noted above, these clinically-observed effects are largely short-lived and reversible. Moreover, as CASAC pointed out, the ranges of effects overlap for all standards. For example, the percent of outdoor children expected to experience effects with a 0.09 ppm, 1 expected exceedance standard ranges from 0.1 percent to 3.5 percent, compared to a range of 0.1 percent to 3.2 percent for a 0.08 ppm, 5 expected exceedance standard. **Thus, while EPA's table does suggest a continuum of risk reduction, the changes in risk are so small, uncertain, and overlapping that no level or number of allowable exceedances emerges as being more protective of public health.**[19]

The second factor considered by EPA are "estimates of exposures to the lowest concentration at which other more uncertain effects have been observed." Here, EPA supports its decision with the observation that fewer outdoor children are likely to be exposed to concentrations of 0.08 ppm under a more stringent standard.[20] This is not a surprising result. However, since there is no threshold of effects at concentrations of 0.08 ppm, it doesn't provide much insight. Furthermore, if, as CASAC Chairman, Dr. Wolff noted in Senate hearings, the average person spends 90 percent of the day indoors, the change in exposure for the whole population as a result of this rule is likely to be very small indeed.

The third factor considered by EPA is the "body of health effects evidence as a whole." Here, EPA observes that in clinical studies, researchers have chosen 0.08 ppm as the lowest level on which to conduct studies, and that this level "does provide a strong point of consistency in the currently available scientific evidence."[21] This "consistency," however, reflects not scientific evidence of threshold effects at 0.08 ppm, but simply the lowest level researchers have chosen to study. Had researchers studied a level of 0.06 ppm, would EPA feel compelled to choose that as its standard? EPA appears to be seeking a threshold, even though it recognizes that ozone may elicit a continuum of biological response, and that no threshold exists.

None of these three factors considers the risk of exposures to ozone in a broader context. For example, these three factors do not reflect the acknowledged fact that the effects of concern are temporary and often asymptomatic. Nor do they reflect the fact that even in the more uncertain

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[18] Though "outdoor children" is the at-risk population at which this rule is targeted, this term are not defined in the preamble.
[19] The President's Council of Economic Advisors (CEA) expresses this concern in its December 13, 1996 comments on EPA's proposal.
[20] Preamble, II(C)(2)
[21] Preamble, II(C)(2)

epidemiological studies, hospital admissions associated with ozone levels represent a very small fraction—0.6% percent—of all hospital admissions for asthmatics. The Presidential/Congressional Risk Commission states that a good policy decision "[c]an be shown to have a significant impact on the risks of concern,"[22] something that has not been attempted in setting this standard.

Perhaps most importantly, these factors do not consider any offsetting health effects associated with reductions in ozone. As discussed more fully below, because tropospheric ozone has the beneficial effect of reducing exposure to harmful ultraviolet rays, any reductions in ozone will have detrimental effects on public health.

3. EPA's proposal may harm public health.

The narrow focus of this decision is unlikely to lead to effective public health outcomes. **Examined in the best light, the proposal may result in small changes in the health of a small number of sensitive individuals.**[23] As noted above, the uncertain scientific evidence suggests that EPA's proposal will provide benefits in the form of transient, reversible, and largely asymptomatic respiratory effects. Hospital admissions from respiratory-related illness are optimistically estimated to decline by less than one percent. As scientists confirmed in Senate hearings on this rule, the vast majority of the population will observe no effect in their health or well-being as a result of this rule.[24] If funds for public health protection were unlimited, this might not be a concern. But this is not the case. As funding for public health programs becomes tighter, such programs need to be as cost-effective as possible, to provide the greatest value to the population.

Even if one focuses narrowly on children with asthma, as EPA does, the proposal is not an effective public health program. EPA defends its proposal in terms of benefits it will provide to children and sensitive individuals with asthma and other respiratory diseases.[25] Asthma is a disturbing health problem, particularly since (a) reported cases have been increasing in recent years (45 percent in the last decade), (b) one-third of its victims are children, and (c) it is most severe among the urban poor. Yet, air quality has been improving over the last decade; ozone levels in particular declined 6 percent between 1986 and 1995.[26] Recently, scientists at the National Institute of Allergy and Infectious Diseases funded a study to solve the paradox of why reported cases of asthma are growing when the factors believed to be causing

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[22] Risk Commission (*op cit*), p. 4.
[23] In its comments dated 12/13/96, the President's Council of Economic Advisors concluded: "Reductions in adverse health effects, even for 'sensitive' populations, are small."
[24] See Dr. Lippman's response to questions by Senator Allard on February 5, 1997.
[25] See, for example, EPA's "Fact Sheet" for this proposal.
[26] USEPA, *National Air Quality and Emissions Trends Report, 1995.*

it, such as air pollution, are declining. The study revealed that "the leading cause of asthma by far was ... proteins in the droppings and carcasses of the German cockroach."[27] The American Thoracic Society concluded:

> Poverty may be the number one risk factor for asthma. ... As with many of the health problems facing society today, education and prevention are the keys to controlling asthma in the inner city.[28]

Thus, even if asthma were the only public health issue of concern, the proposal does not stand up to scrutiny. The potential impact on those afflicted with the disease is very small, and the costs of the rule will drain society's resources from more effective remedies.

The ineffectiveness of the proposal as a public health program becomes even clearer when one considers public health issues more broadly. **The proposed change in the ozone standard will increase malignant and non-melanoma skin cancers and cataracts, as well as other health risk from ultraviolet radiation.** However, rather than presenting these important tradeoffs, EPA explicitly ignores information on the offsetting health effects caused by the effect of ozone on ultraviolet radiation. EPA's own analysis indicates that these effects could dwarf the positive benefits EPA attributes to the proposed standard. As detailed in Appendix B to these comments, the proposed 10 ppb change in the ozone standard could result in 25 to 50 new melanoma-caused fatalities, 130 to 260 incidents of cutaneous melanoma, 2,000 to 11,000 new cases of non-melanoma skin cancer, and 13,000 to 28,000 new incidents of cataracts *each year*.

When one considers the cost of the proposal, it becomes even more evident that it is not an effective way to protect public health. EPA argues that it may not consider implementation costs, only public health concerns, when setting NAAQS. Yet regulatory costs themselves affect public health. The Risk Commission recognizes the importance of such cost-health tradeoffs, noting that risk management decisions should consider "diversion of investments, or opportunity costs—such as having to spend money on environmental controls instead of using those resources to build a school or reduce taxes."[29]

As the Risk Commission points out,

> There may be even broader public health or ecological contexts that local governments and public health agencies have to confront and weigh against chemical exposures—for example, a

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[27] *Chemically Speaking*, July 1996.
[28] American Thoracic Society, 1996 Conference Articles.
[29] Risk Commission, p. 33

> high incidence of HIV or other infections, a low rate of childhood vaccination, a high drug use and crime rate, or a high rate of alcoholism and its contribution to liver disease, birth defects, and injuries from automobile accidents.[30]

The annual budgets of the agencies charged with protecting the public health are small in comparison to the cost of this proposal. For instance, for carrying out its responsibilities with respect to cardiovascular, lung, and blood diseases, and blood and blood products, the National Heart, Lung and Blood Institute has been allocated less than $1.5 billion in 1988. Similarly, the 1998 budget allocates the National Institute of Child Health and Human Development $0.6 billion for research and programs related to child health and human development. The National Institute of Environmental Health Science has been allocated $314 million. Thus, EPA's estimates of the partial costs of attaining the proposed standard ($0.6 billion to $2.5 billion per year) exceed the amounts allocated for federal programs aimed directly at protecting children's health and respiratory health.

The costs of this proposal will increase health risk. Implementation of this rule will impose costs on every aspect of our lives. Goods and services will be more expensive, causing disposable family income to decline. **If, as recent studies suggest, poverty is a more important risk factor for asthma than air quality,[31] the rule may well increase the very disease it is purportedly targeted at improving.** Even without this direct link between poor living conditions and asthma, it is widely recognized that, as family incomes rise, health improves. There is a growing body of empirical evidence regarding the negative public health impacts of regulatory programs that reduce incomes. As described in the Regulatory Program of the United States,

> Health-health analysis computes the unintended risk increase attributable to the decline in spending on other risk reduction efforts that results when resources are shifted to comply with a regulation aimed at specific risks. Regulations have these unintended risk-increasing effects because families and other entities spend less on such items as health care, nutritious diets, and home and auto safety devices when their incomes decline.[32]

The studies linking income and mortality find that every $9 million to $12 million decline in income induces one statistical death.[33] EPA estimates that the cost of achieving partial compliance with its proposal will involve annual costs of $0.6 to $2.5 billion. We estimate that the full costs are likely to exceed

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[30] Risk Commission, p. 10
[31] American Thoracic Society, 1996 Conference Articles.
[32] *Regulatory Program of the United States Government*, April 1, 1992 - March 31, 1993. p. 19.
[33] Lutter & Morrall. *Journal of Risk and Uncertainty*, 8:43-66 (1994)

$51 billion per year.[34] Using the $9 million to $12 million figure, **EPA's partial cost estimate would imply an increase in mortality in the range of 50 to 278 deaths each year. If our estimate of the full costs is accurate, the cost of this rule would result in an increase in 4,250 to 5,667 deaths per year.** (These estimates do not include the increase in melanoma deaths from UV-B exposure.)

D. Evaluation of EPA's Decision Regarding the Secondary Standard

As with the primary standard, there appears to be no threshold concentration below which ozone elicits no "welfare effects," such as effects on soils, water, crops, property, etc. This section examines the factors that went into EPA's policy judgment in selecting the secondary standard, and evaluates the proposal from a public welfare context.

1. EPA's expressed interpretation of the statute leads to outlandish outcomes.

In the preamble to the proposed standard, EPA observes:

> The explicit inclusion of economic values in the list of potential public welfare effects of the presence of criteria pollutants in the ambient air has led to the suggestion by some that EPA may consider a broad array of economic values, including both the potential disbenefit as well as the benefits associated with reducing air pollution in making decisions with regard to secondary standards.[35]

However, EPA rejects this notion, arguing that nothing in the statutory language "provides any indication that EPA may base its secondary standards on factors other than the effects of the pollutant at issue on welfare."[36] EPA interprets this to exclude consideration not only of the costs of controls, but also "any alleged negative effect that reducing ambient concentrations of the relevant pollutant or its precursors may have on public welfare."[37]

In other words, EPA argues it cannot consider the wealth or inconvenience impacts of secondary standards, even though those impacts certainly influence personal comfort and well-being, which the act defines as welfare

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[34] See Section IV and Appendix C.
[35] Preamble, IV.
[36] Ibid.
[37] Ibid.

effects. **EPA further circumscribes its decision to include only the negative effects of the compound in question, while excluding its positive effects.**

While the preamble sets forth EPA's interpretation of the law, the agency solicits public comment on "the view that economic values be broadly construed to include the possible disbenefits and benefits resulting from implementation of standards for the purpose of establishing secondary standards."

We believe that, if public welfare is truly to be protected, economic values must be construed broadly. Furthermore, we believe EPA's framework for setting secondary standard is seriously flawed. We find EPA's exclusive focus on the harmful effects of the pollutant itself artificially narrow, and unlikely to result in decisions that improve public welfare. EPA admits that the selection of the levels for the primary and secondary standard are public policy decisions, and that the statutory language does not call for a standard of zero.

Following EPA's expressed logic that only the negative effects of a compound can be considered can lead to outlandish results. As an example, oxygen is toxic in high doses, making it a public health concern. Moreover, it causes fires, and severe materials damage, which are public welfare concerns. If oxygen were classified as a criteria pollutant it certainly would have to be banned due to its extremely adverse effects on health and welfare, without regard to its benefits in sustaining life (which, under EPA's interpretation, would be considered "disbenefits" of reducing oxygen levels).

This example highlights the flaws in the framework for standard setting that is expressed in the preamble to this rule. We present it to illustrate the problems generated by the constraints EPA claims the CAA imposes on its decision under the NAAQS.

2. The scientific evidence underlying EPA's secondary standard is weak.

EPA presents two policy choices for public comment: one is a standard identical to the primary standard, and the other, labeled the SUM06 exposure index, is based on the sum of hourly concentrations that exceed .06 ppm. The selected level of the standard suffers from problems similar to those articulated above for the primary standard. In addition, the proposed form of the SUM06 exposure index is not grounded in science. The preamble notes that, "the Administrator recognizes that there is no biological evidence of an effects threshold, and that the effects studies we see do not establish that the SUM06 index best accounts for all of the biologically relevant exposures." Given this conclusion, the agency should not make an arbitrary selection regarding the form of the secondary standard.

EPA focuses on a narrow range of welfare effects, which are themselves highly uncertain. Although the statute lists a range of welfare effects that may be considered, including economic values, personal comfort, and well-being, EPA bases its proposed alternatives largely on effects on vegetation. Visible foliar injury and crop growth/yield reductions are documented in controlled experiments, and foliar injury has been observed in national parks and wilderness areas. CASAC identified various concerns with the controlled experiments, including (1) baseline ozone levels lower than normal background concentrations overstate the effects of ozone on vegetation, (2) the concentrations and durations in the experiments were greater than would exist under the current standard, and (3) the design of the open-top chamber studies overstates effects. Field observations are difficult to evaluate, due to their uncontrolled nature. It is not clear from the preamble whether the observations of growth reductions and foliar damage control for other confounding factors, such as heat and insects. However, EPA does admit that studies of crops, seedlings and trees all "showed that sensitivity to O_3 varied significantly between tree type and growth strategy and between species and types within species."[38]

In its April 4, 1996 closure letter on the secondary standard, CASAC observed that "given the crudeness of the risk assessment estimates, policy decisions cannot be based firmly on science." Vegetation experts on the panel agreed that "plants appear to be more sensitive to ozone than humans." Yet, they had divergent opinions on the recommended form and level for the secondary standard, and raised substantial concerns with the risk assessment.[39]

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[38] Preamble IV(A)(3)

[39] The CASAC closure letter states: "The first issue is the level of uncertainty associated with the crop loss risk assessment presented in ... the Staff Paper. ... The estimates in these Tables should only be presented as rough estimates for a number of reasons. First, the dose-response functions are based upon open-top chamber studies... Two of the plant experts said that the open-top chamber experiments by their very design and execution produced results that overestimated the effects of ozone on plant yield. ... Second, the estimated exposures are based on a non-peer-reviewed, empirical model which has not been subjected to any performance evaluation. Third, the estimated exposures are then extrapolated to hypothetical scenarios where various secondary NAAQS are attained. Details of this extrapolation procedure are also insufficient to judge the appropriateness of the procedure. Fourth, the exposure estimates are then extrapolated to the entire coterminous U.S. using a Geographic Information System (GIS) which is based on an unpublished, non-peer-reviewed, internal EPA memorandum that contains insufficient details to adequately evaluate the GIS. The exposure estimates and the dose-response function estimates are then input into the economic models which introduce additional uncertainties. Furthermore, the losses are computed from an assumed 12-hr. background ozone concentration of 0.025 ppm which is too low and will over-inflate the crop loss estimates. A more reasonable 12-hr. daylight, summertime background is more likely closer to the 8-hr. background of 0.03-0.05 ppm."

> As a result, the Panel felt that the absolute values of the numbers in Tables VII-5a-VII-7 [of the Staff Paper] are highly uncertain estimates of crop losses and are a result of a propagation of uncertainties. They are rough estimates, and this should be explicitly stated in this discussion. The Panel believes, however, that these Tables can be of some use in identifying rough relative incremental benefits associated with a given NAAQS as long as it is recognized that small differences in benefits may have no significance because of these uncertainties.

Thus, even if the only welfare effect of concern to society were vegetation effects, it is unlikely that the proposed standards would have a significant impact.

3. EPA ignores important welfare effects.

Welfare effects, as defined by the act, include "effects on economic values and on personal comfort and well-being." EPA's narrow focus on vegetation effects ignores these, more generally recognized, welfare effects.

Economic values, personal comfort, and well-being will be negatively affected by the proposed secondary standards. This rule will impose enormous costs on society. To achieve EPA's estimated vegetation benefits in the range of $10 million to $230 million,[40] EPA estimates that the proposal would impose costs of $600 million to $2.5 billion. In addition to the large direct costs to comply (partially) with this rule, opportunity costs will mean a decline in economic growth and a diversion of scarce resources from other uses. EPA does not estimate the impact on economic growth for the significant number of areas that will be classified as nonattainment due to the continuing cost of restrictions associated with nonattainment status. As family wealth decreases, less money would be available for things that increase personal comfort, well-being, and health. Implementation of this rule will also involve many personal sacrifices affecting such individual decisions as the cars we drive, and whether we can enjoy outdoor barbecues and campfires.

4. EPA ignores offsetting effects on vegetation and other welfare categories.

EPA's exclusive focus on the harmful effects of ozone on vegetation preclude it from considering any beneficial effects of ozone. As discussed in Section III of these comments, tropospheric ozone has the beneficial effect of dispersing

[40] These are partial benefits of partial attainment reported in the RIA. The benefits EPA reports in the preamble are for full attainment of a more stringent standard than that proposed for the primary standard.

harmful ultraviolet radiation, which damages crops, fisheries, and materials. **We estimate in Appendix B that the offsetting UV-B damage from fully attaining a standard set equal to the primary standard will range from $5.3 million to $291.8 million.**

E. Conclusions Regarding EPA's Proposed Ozone Standard

EPA recognizes that in setting the primary and secondary NAAQS for ozone it must make a policy decision. EPA admits that its mandate is not a zero risk standard, yet it artificially circumscribes the factors it is allowed to consider in a way that precludes recognition of important tradeoffs. It is essential to recognize that these tradeoffs exist, whether or not EPA admits to them.

We offer the following conclusions with respect to EPA's proposed revision to the ozone NAAQS.

1. The proposed primary standard will not improve public health.

- At best, the proposed level of the primary standard will result in small changes in health for a small population of sensitive individuals. The vast majority of the population will experience no change in health.

- It is more likely that the proposal will actually harm public health, by increasing risks associated with ultraviolet radiation.

- When the costs of the proposal are considered, the negative impact on public health is even more dramatic. Poverty is a significant, if not the most important, determinant of childhood asthma, yet the huge costs of this proposal will put more children in poverty.

2. The proposed secondary standard will not improve public welfare.

- Even if one were to accept EPA's estimates, at best, the proposed NAAQS revision will reduce damage to vegetation by a small amount.

- Offsetting welfare effects, including increased UV-B damage to crops, fish, and materials, and reduced personal comfort and well-being, will swamp the expected net crop benefits of the proposal.

- Public welfare is more likely to be reduced substantially due to the huge costs and personal sacrifices involved in implementing the proposal.

3. More effective alternatives are available for addressing the potential ill effects of ozone.

- Non-regulatory approaches are available to achieve the public health benefits targeted by this rule. As CASAC recommended in its November 30, 1995 closure letter on the primary standard, public health advisories and other targeted approaches may be an effective alternative to standard setting.

  > Because there is no apparent threshold for responses and no "bright line" in the risk assessment, a number of panel members recommended that an expanded air pollution warning system be initiated so that sensitive individuals can take appropriate "exposure avoidance" behavior. Since many areas of the country already have an infrastructure in place to designate "ozone action days" when voluntary emission reduction measures are put in place, this idea may be fairly easy to implement.

- Research and education are more likely to target what experts believe to be the true reason behind the increasing incidence of asthma—poverty and poor living conditions.

4. EPA should not proceed with promulgation of the proposed standard.

- In light of CASAC's conclusion that the proposed standard (level and number of exceedances) is not significantly more protective of public health than the alternatives examined, and the very real concern that implementation of this rule will actually harm public health and welfare, EPA should not proceed with its promulgation.

- There may be adequate basis for changing the *averaging time* and *form* of the standard. However, as the majority of EPA's science panel concluded, scientific evidence suggests that a *level* more stringent than the current level is not necessary to protect public health. Moreover, since our analysis suggests that the current *level* of the standard already imposes social costs (both in terms of health and welfare) that exceed its benefits, EPA should not select a level and number of exceedances that is more stringent than the current standard.

on which EPA requests comment. EPA suggests that benefits (and costs) of the proposed 8 hour, 0.08 ppm standard based on a average of the 3rd highest concentrations will fall within the range of benefits estimated for 8 hour, 0.08 ppm standards that allow 1 and 4 exceedances.[4] EPA also requests comments on a less stringent 0.09 ppm alternative, and a more stringent 0.07 ppm alternative, but does not analyze the benefits or costs of these alternatives. EPA asserts that benefits of the 0.09 ppm standard will be equivalent to the benefits estimated for the current 1 hour, 0.12 ppm standard, and that benefits of the 0.07 ppm standard will be equivalent to the benefits estimated for an 8-hour, 0.08 standard with one exceedance.[5] This assertion of equivalence is based on the that models predict the alternatives will have an equivalent number of areas that are classified as being in nonattainment, however. This does not necessarily imply equivalence in either benefits or costs because (1) different areas will be in nonattainment under each alternative, (2) there are different degrees of nonattainment under each alternative, and (3) different populations would be exposed in different nonattainment areas.

b) EPA's approach to estimating baseline 2007 concentrations

EPA's estimates of the benefits of each alternative are based on ambient concentrations of ozone in 2007. To estimate baseline concentrations in that year, EPA starts with 1987 meteorological data and 1990 monitoring data from which it projects an emissions inventory for 2007. Projected 2007 emissions reflect both (1) economic and population growth (which increase 2007 emissions compared to 1990 emissions), and (2) the estimated effects of CAA-mandated controls that will be put in place between 1990 and 2007 (which serve to decrease 2007 emissions).

EPA examines two baselines: its preferred "analytical baseline," which assumes regional controls are in place by 2007 (the regional control strategy or RCS baseline), and its local control strategy (LCS) baseline, based on the assumption that only local control strategies are in place.

To translate emissions into concentrations, EPA relies on its regional oxidant model (ROM), which models only the Eastern U. S. for a ninety-day period during the ozone season. ROM estimates concentrations at each monitor in the eastern U.S. in 1990 and 2007. By regressing estimated concentrations at

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[4] In section III(A) of the RIA, EPA states that the benefits of the proposed standard (8H2AX-80) will fall within the range of benefits estimated for two analyzed alternatives—8H1AX-80 and 8H4AX-80.

[5] EPA asserts that "for analytical purposes, the 0.09 ppm alternative is similar to the current 1H1EX-120 standard, and the 0.07 ppm alternative provides a level of protection similar to the 8H1AX-80 form." RIA III(A)

existing Eastern U.S. monitor locations in 1990 against the 2007 concentrations at the same locations, EPA derives a coefficient representing the expected change in concentration over the period. This coefficient (.79) reflects the average expected change in concentration, and is applied to 1990 concentrations at all monitors (including those not covered by ROM) to project concentrations at all monitors in 2007.

These estimates of 2007 concentrations at existing monitors are then interpolated to estimate concentrations at the geographic center of each county in the forty-eight contiguous United States. (EPA refers to this regression and interpolation procedure as the "Centroid methodology".)

EPA's OZ-ONE computer model estimates changes in health effects and economic benefits due to estimated changes in ambient ozone. It uses a "quadratic rollback method" to estimate post-control concentrations for each NAAQS scenario. This rollback approach assumes that efforts to meet the standard in nonattainment areas during peak hours will result in pro-rated reductions in concentrations in attainment areas[6], and during off-peak hours.

c) EPA's approach to estimating benefits of the primary (health based) standard

(1) Health Effects

EPA relies on human clinical studies and epidemiology studies to quantify the health effects of the change in ozone concentrations. Because the two approaches (clinical studies and epidemiology studies) represent different methods for calculating the same health effects, EPA does not sum their results, but uses them to define a range of health effects.[7] EPA quantifies and assigns dollar values to the following health effects: cough, pain upon deep inhalation, mortality, hospital admissions for all respiratory illnesses, hospital admissions for pneumonia, and hospital admissions for chronic obstructive pulmonary disease (COPD).

(2) Valuation

With the exception of hospital admissions and mortality, valuations are based on contingent valuation surveys of individuals to determine their hypothetical willingness to pay to avoid an incident involving these effects

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[6] Welfare, but not health, benefits are quantified for assumed air improvements in attainment areas.

[7] The clinical approach generally produces larger benefits, except when mortality is considered (for the high estimate of EPA's range).

(e.g., a day of coughing). For hospital admissions, EPA doubles the estimates derived from cost information (and used in previous analyses) to approximate willingness-to-pay. This "adjustment factor" is applied to cost-based values to correct a perceived understatement in willingness-to-pay.

d) EPA's approach to estimating benefits of the secondary (welfare) standards

The RIA also quantifies and values effects of a reduction in ozone on commodity crops, and fruit and vegetable crops. It discusses qualitatively the effects on other welfare endpoints, including ecosystem effects, damage to urban ornamentals, materials damage, and visibility. EPA's model uses statewide average changes in ozone concentrations (computed from the county-level concentrations described above) and exposure-response functions to predict changes in crop yield, and change in economic surplus by crop for each alternative standard.

e) Summary of annual health and welfare benefits

Table 1, below, presents the range of benefits estimated by EPA for the two analyzed standards that bracket the proposal. EPA expects that full attainment of the proposed standard will provide annual benefits of between $76 million and $2.8 billion assuming regional controls are already in place. Estimated from a baseline that does not assume regional controls, benefits of fully attaining the proposed standard range from $109 million to $3.8 billion.

EPA also estimates the benefits of partially meeting the standard (for comparison with its cost estimates). These range from $12 million to $1.5 billion under the regional control baseline, and $54 million to $2.1 billion under the local control baseline.

Table 1[8]
Summary of Annual Health and Welfare Benefits
Year = 2007
(Millions; 1990 $)
(Estimates are incremental from the current standard)

Ozone NAAQS	Regional Control Strategies Baseline		Local Control Strategies Baseline	
	Full Attainment Scenario	Partial Attainment Scenario	Full Attainment Scenario	Partial Attainment Scenario
.08 ppm, 8-hour, 4 ex. (less stringent)	$76 - $1.403	$12 - $647	$109 - $2.041	$54 - $1.064
.08 ppm, 8-hour, 1 ex. (more stringent)	$202 - $2.809	$69 - $1.453	$200 - $3.807	$123 - $2.085

2. Summary of EPA's methodology for estimating costs.

EPA uses several steps to estimate the cost of the proposed standard. First, EPA projects concentrations by county to 2007, and determines baseline attainment status in that year. Second, EPA estimates the tons of ozone precursor pollutants (volatile organic compounds (VOCs)) and nitrogen oxides (NOx)) that would have to be reduced in order to meet the standard. Third, EPA estimates the cost of the technologies necessary to reduce the pollutants by the necessary amounts.

The analysis is complicated by the need to convert ambient concentrations of ozone into the number of tons of pollutant that would need to be reduced. Furthermore, existing and anticipated control technologies are insufficient to achieve the emission reductions necessary to meet the proposed standard in many areas in the foreseeable future. EPA chose to exclude from its inventory of possible controls those with costs that exceed a certain threshold per pound of pollutant reduced. All these steps are discussed in more detail below.

a) Estimating ambient concentrations and attainment status in 2007

To determine the number of tons of ozone precursors that must be reduced to achieve the proposed standard, EPA establishes the year 2007 as its analytical baseline. The RIA assumes that ambient ozone concentrations in that year reflect the full and vigorous adoption and implementation of a number of air pollution regulations and initiatives that are currently proposed or being

[8] This is a reproduction of RIA TABLE IX-7.

discussed. For instance, EPA assumes that the following are in place and fully effective:

- all Title I VOC and NOx Reasonably Available Control Technology (RACT) standards,
- Title II mobile source inspection/maintenance programs,
- Title III air toxic controls,
- Title IV Acid Rain NOx controls, and
- Resource Conservation and Recovery Act (RCRA) treatment storage and disposal facility (TSDF) and landfill regulations.

Overall, EPA assumes actions expected under the 1990 amendments to the Clean Air Act (CAAA) will reduce emissions of VOCs in the year 2007 by an additional 6.3 million tons per year[9] and NOx by an additional 8.3 million tons per year over their current levels.[10] The costs of achieving these reductions are all included in EPA's baseline and, thus, are not attributed to this rule.

EPA's analytical baseline also includes the strict application of Title I subpart (2) requirements and implementation of a regional NOx strategy in the 37 Eastern states. The RIA states, "[t]he staff believes that these [regional NOx] efforts will be in place in the year 2007, and because they are being undertaken to attain the current ozone NAAQS, they should be included in the analytical baseline of this RIA."[11] The RIA refers to this baseline as its "Regional Control Strategy" or RCS.

EPA developed a second "Local Control Strategy" or LCS baseline, which it considers to be an upper bound on the costs. The difference between the two baselines is that RCS includes a 0.15 pounds-per-million BTU cap on NO_x emissions from utilities and other combustion boilers, and a California-style low emission vehicle (LEV) program applied to each county in the Eastern U.S. (the "ROM domain") prior to the identification of areas where local ozone controls are still needed.[12] These measures do not appear to be mandated by any statutory authority.

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[9] RIA Table 4-1
[10] RIA Table 4-2
[11] RIA IV(B(3)
[12] RIA IV(B(3)

Assumptions regarding what controls are included in the baseline have an important impact on EPA's cost estimates. Any and all costs of controls used to achieve baseline emission levels are not included in the cost of achieving the current ozone NAAQS, nor the proposed revisions. As discussed below, the greater the reductions EPA assumes are achieved by other actions by 2007, the lower the ambient concentrations of ozone, and the lower will be EPA's estimate of the cost for States and cities to meet the standard proposed in this rule.

b) Estimating the reductions in pollutants

Once EPA has estimated baseline ambient ozone concentrations in 2007, it attempts to determine the reduction in pollutants in each area necessary to achieve each of the four alternative standards analyzed.[13] EPA determines the reductions needed based "on the expertise of its air quality modelers," who rely on a combination of models, including the ROM model which is limited to the Eastern United States, and its UAM (Urban Airshed Model), which predicts air quality in specific metropolitan areas.[14]

c) Cost of compliance

Once EPA has determined where emissions would have to be reduced and by what amounts, it applies control measures to the areas the model predicts will be out of attainment. EPA's inventory of control measures includes:

- Controls on stationary point sources, such as
    - selective catalytic reduction on utility and industrial boilers,
    - controls on surface coating,
    - bans on open burning,
- Controls on stationary area sources, including
    - cutting back on asphalt,

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[13] As stated above, none of the four alternatives in the RIA reflect the proposed standard nor alternatives described in the preamble.

[14] "For areas outside the ROM domain, the analysis relied upon advice from air quality modelers and air chemists to establish targets for each eight hour alternative standard. For identified nonattainment areas which had no ROM or UAM modeling, targets were assigned for these 'new' areas that were similar to the targets in 'similar' nonattainment areas which had been modeled, using geographic characteristics as a measure of similarity." RIA V(C)

  - restricting pesticide applications, and
  - applying controls on residential water and space heaters and small combustion sources.

- Requirements for on and off-road motor vehicles (such as lawn and garden equipment, as well as marine vessels and recreational vehicles), including
  - emission standards and
  - reformulated gasoline.

Appendix D to these comments reproduces EPA's Table C-1, which lists incremental control measures and potentially affected source categories.

Each control measure in EPA's inventory is applied in order of cost-effectiveness (that is, the one with the lowest per-ton costs first and ascending to most expensive last) until the area is determined to be in attainment or until additional pollution reduction technology is "unavailable." EPA chose not to include in its inventory of available control technologies those for which the costs-per-ton of precursor emissions reduced is greater than $30,000 to $80,000 per ton.[15]

The cost of each technology used is then totaled up to determine the cost by county of attempting to meet the standard in the base year (2007). EPA did not attempt to estimate costs other than the direct costs of applying pollution control technology.

Table 2 summarizes EPA's estimated costs of meeting the current standard and of attempting to meet the two options that most closely bound the proposed standard (under both the "RCS" and "LCS" assumptions).

[15] Note that EPA's exclusion of the more expensive control measures from its cost estimates in this RIA does not reflect any policy decision that these measures will not, in fact, be required to meet the standard.

Table 2
EPA's Estimated Cost of Partial Attainment

Standard	Range of Estimated Annual Costs to Achieve Partial Attainment (Billions of 1990$)	
	With Regional Controls (RCS)	Without Regional Controls (LCS)
Current Standard 0.12 ppm, 1 hour, 1 ex.	$1.2 billion	$2.3 billion
0.80 ppm, 8 hour, 4 ex. (less stringent than proposal)	$0.6 billion above cost of current standard	$2.2 billion above cost of current standard
0.80 ppm, 8 hour, 1 ex. (more stringent than proposal)	$2.5 billion above cost of current standard	$6.3 billion above cost of current standard

EPA estimates that the incremental cost of the proposed standard is likely to be between $600 million a year (the estimate for the less stringent option assuming regional controls) and $6.3 billion a year (the estimate for the more stringent option assuming no regional controls). EPA does not estimate costs associated with the secondary standard on the assumption that the primary standard will be binding in most of the country.[16]

3. Comparison of EPA's estimated costs and benefits

EPA's estimates of the benefits and costs of partially meeting the current ozone NAAQS and the proposed alternative are presented in Tables 3a (using EPA's RCS baseline) and 3b (under the LCS baseline). The results are striking. **To achieve partial attainment with the existing NAAQS, EPA predicts that Americans will have to pay between $400 million and $2.2 billion each year more than they will receive in health and welfare benefits. EPA estimates that partial compliance with the proposed standard will impose costs in excess of benefits of up to $6.2 billion more each year.**

[16] RIA VI(B)(2)

Table 3a
Comparison of Benefits and Costs
Regional Control Strategy Baseline
(Billions of 1990 $)

Alternative NAAQS	Annual Benefits	Annual Costs	Net Benefits (Costs)
0.12 ppm, 1- hour, 1 ex. (current standard)	$0.1 - $0.8	$1.2	$(0.4) - $(1.1)
0.08 ppm, 8-hour, 4 ex. (less stringent)	$0 - $0.6	$0.6	$0 - $(0.4)
0.08 ppm, 8-hour, 1 ex. (more stringent)	$0.1 - $1.5	$2.5	$(1.0) - $(2.4)

Table 3b
Comparison of Benefits and Costs
Local Control Strategy Baseline
(Billions of 1990 $)

Alternative NAAQS	Annual Benefits	Annual Costs	Net Benefits (Costs)
0.12 ppm, 1- hour, 1 ex. (current standard)	$0.1 - $1.1	$2.3	$(1.2) - $(2.2)
0.08 ppm, 8-hour, 4 ex. (less stringent)	$0 - $1.1	$2.2	$(1.1) - $(2.4)
0.08 ppm, 8-hour, 1 ex. (more stringent)	$0.1 - $2.1	$6.3	$(4.2) - $(6.2)

C. Comments on EPA's RIA

EPA emphasizes in the preamble of the rule that the selection of the level of the ozone NAAQS is a policy judgment. A good policy judgment must be guided by an unbiased and clearly articulated presentation of the range of alternative standards and their impacts on health and welfare. **This RIA does not provide adequate information with which to make a good policy decision.** Moreover, the RIA does not meet the fundamental requirements of President Clinton's Executive Order 12866, which requires analyses to inform decision-makers of the consequences of alternative actions.

The RIA does not analyze either the proposed standard, nor the two alternatives on which the public is asked to comment. More importantly, it does not consider important costs and public health considerations. Key assumptions bias the results. In the face of the many uncertainties

encountered in this analysis, EPA makes inconsistent assumptions in estimating benefits and costs. For example, EPA's assumptions about the number of areas that can attain alternate standards lead to an understatement of the costs of partial attainment. However, EPA makes no corresponding adjustments when estimating the benefits of bringing noncompliance areas partially into attainment.

Below we evaluate and comment on the RIA EPA has prepared for the proposed revision to the ozone NAAQS. We review EPA's benefit estimates in section 1, and present the results of our own analysis regarding the health and welfare effects of the proposal. In section 2, we comment on EPA's cost estimates and summarize our own estimates of the full cost of compliance. Appendices A, B, and C provide more detail on the analyses we conducted to adjust EPA's estimates of benefits and costs.

1. EPA overstates the health and welfare benefits of the proposal.

As presented in section B, above, EPA estimates that the proposed standard will provide health and welfare benefits in the range of $12 million to $2.1 billion per year. In evaluating EPA's reported range of benefits, it is important to consider the following points.

a) The scientific basis for the health and welfare risks is weak.

There is much uncertainty in the current scientific understanding of the effects of ozone on health and welfare. EPA's analysis necessarily makes numerous assumptions in the face of these uncertainties, some of which may have important implications for the resulting benefit estimates. On balance, EPA's assumptions are likely to result in an overstatement of benefits.

As EPA's Clean Air Science Advisory Committee (CASAC), which advised EPA on the scientific foundation for the ozone NAAQS policy, stated: "there are still many gaps in our knowledge and large uncertainties in many of the assessments."[17] The many assumptions that have to be made to quantify and then value health and welfare effects necessarily introduce large uncertainties in the results.

The Executive Summary and Chapter IX of the RIA discuss the gaps in EPA's understanding of ozone effects, but assert that limitations in the analysis

[17] CASAC Closure on the Primary Standard Portion of the Staff Paper for Ozone. November 30, 1995.

serve to understate benefits.[18] A review of the RIA and supporting analysis suggests that, while there are factors which may cause benefits estimates to be understated (such as EPA's inability to quantify and value uncertain health and welfare effects), there are also many assumptions that result in the overstatement of benefits. For example, EPA's "rollback" approach to estimating post-control air quality is likely to overstate air quality improvements during off-peak periods. Its assumptions regarding meteorological conditions in the year 2007 may also overstate baseline air quality and, therefore, the benefits of meeting the standard. Further, EPA's reliance on a single study that found evidence of mortality effects, despite the existence of at least eleven studies that did not, and despite the fact that this study has not been reviewed by CASAC, is likely to overstate the upper end of the range of estimated benefits. For welfare benefits, CASAC questioned several methods and assumptions which are likely to overstate benefits.

These and other uncertainties in EPA's benefit and cost analysis are discussed in more detail Appendix A.

b) EPA relies on questionable methods for valuing health effects.

Values estimated by contingent valuation (CV) techniques, in which people are asked hypothetical questions about how much they are willing to pay to avoid certain effects, are used in this analysis. This approach is controversial because of its tendency to overstate benefits. As discussed in Appendix A, direct measures of the value people attribute to health effects are superior to values based on hypothetical questions.

Values attributed to reduced mortality dominate the upper bound of EPA's benefit range. Given the weak foundation for EPA's estimates of ozone-induced mortality, these values should be excluded from EPA's analysis.

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[18] For example, in discussing the general limitations of the analysis, the Executive Summary states:

> Analyses, and therefore results, continue to be limited by the inability to monetize certain health or welfare benefits - such as protection against loss of lung function, or ecosystem damage. Comparisons of such incomplete benefits to the more quantifiable and usually more complete control costs can be misleading.

This statement is certainly misleading with respect to this particular analysis because the RIA (1) only estimates the direct costs of partially attaining the standard, and (2) omits important categories of costs.

c) EPA ignores negative impacts on health and welfare.

Ozone (both in the stratosphere and in the troposphere) affects the dispersion and penetration of ultraviolet B (UV-B) radiation. Reductions in ground-level (tropospheric) ozone as a result of a revised ozone NAAQS will cause total column ozone to decrease, increasing the penetration of UV-B rays.

The last paragraph of the RIA states that "no attempt to quantify this potential effect, which is expected to be small, has been made in this analysis." However, a review of EPA's analysis of UV-B effects (for this rule and previous rules) indicates that **the negative health benefits (or health costs) associated with the UV-B effects of the proposal could exceed the health benefits EPA attributes to ozone reductions by almost $250 million per year.**

In Appendix B, we attempt to quantify and value the harmful effects of the increase in UV-B radiation that would result from the proposed change in the ozone NAAQS. Our analysis is based solely on methods, models and data used by EPA in previous analyses of the benefits of reducing chemicals that affect stratospheric ozone. It suggests that implementation of the proposal will result in between 2,000 and 11,000 new cases of nonmelanoma skin cancer; 130 to 260 new cases of cutaneous melanoma, 25 to 50 melanoma caused deaths, and 13,000 to 28,000 incidents of cataracts. As shown in Table 4, we estimate that the costs of these health effects (or "disbenefits" in EPA's terms) range from $333 million to $1.3 billion (1990 dollars). These estimates are consistent with estimates made by others.[14] We estimate that the negative welfare effects on commercial fisheries, commodity crops and polymers will range from $6.3 million to $347.2 million per year.

[14] See Lutter & Wolz and Frazier.

Table 4
Net Benefits of Ozone NAAQS
(Millions 1990 $)

		Lower Bound	Best Estimate	Upper Bound
Health	NAAQS RIA	$4.0	$85.7	$3,197.0
	Offsetting UV-B effects	$333.1	$367.5	$1,310.1
	Net Benefits	**$(329.1)**	**$(281.8)**	**$1,886.9**
Welfare	NAAQS RIA	$72.0	$207.5	$610.0
	Offsetting UV-B effects	$6.3	$92.8	$347.2
	Net Benefits	**$65.7**	**$114.7**	**$262.8**
Total (health and welfare)	NAAQS RIA	$76.0	$293.2	$3,807.0
	Offsetting UV-B effects	$339.4	$460.2	$1,657.3
	Net Benefits	**$(263.4)**	**$(167.0)**	**$ 2,149.7**

2. EPA's estimate of costs is flawed.

The RIA estimates that the cost of partially attaining the proposed standard will range from $600 million to $6.3 billion a year (in 1990 dollars). In order to understand this estimate it is important to consider the following points.

a) EPA's estimates are highly uncertain.

There are significant uncertainties involved in estimating the costs of the proposal. EPA's cost estimates include assumptions that may significantly bias the estimates both up and down. On balance, as discussed in Appendix A, EPA's assumptions are likely to result in an understatement of costs.

b) EPA understates the number of areas that will be out of attainment.

EPA's cost estimate assumes that counties that achieve only 75% of the reductions necessary to meet a standard of 0.092 ppm will incur no further costs associated with compliance. Since, in reality, EPA's proposal would

require states and cities to make the necessary reductions in pollution to fully meet the 0.08 ppm standard to be classified as in attainment, these assumptions significantly understate the costs of meeting the proposed standard. (Note that EPA considers an eight-hour standard of 0.09 ppm similar to the current standard.[20] So, this RIA is evaluating the cost of partial compliance with a standard—0.092 ppm—that is actually **less stringent** than current regulations.)

c) EPA's estimate omits important categories of costs.

Costs of the proposed standard include offsetting health and welfare costs ("disbenefits"), costs to Federal facilities, and costs to States, cities, EPA, and regulated entities to administer and comply with the new standard, yet EPA's estimate does not include any of these. EPA also does not estimate the detrimental impact on economic growth for the significant number of areas that will be classified as nonattainment.

d) EPA's baseline includes costs that are better characterized as incremental.

All EPA's cost estimates (for achieving the current ozone NAAQS as well as the proposed alternatives), are incremental to a baseline in 2007. The definition of this baseline strongly influences the cost estimates, because the costs of emission reductions that are attributed to the baseline do not appear as incremental costs of either the current standard nor the proposed standard. To the extent EPA overestimates the effectiveness of other regulations and discretionary measures in its baseline, the actual costs of this new standard will be underestimated. There is reason to believe EPA's analytical baseline includes (1) overestimates of the effectiveness and implementation of new regulations put in place prior to 2007 and (2) emission reductions from actions that in fact are related to the current and proposed ozone NAAQS.

e) The RIA presents estimates of costs (and benefits) for a single year: 2007.

EPA does not suggest that this "snapshot" approach reflects the expected annual costs (or benefits) of the proposed standard. Rather, EPA selected 2007 because by then it expects "most of the mandatory CAAA requirements will have fully taken effect and most areas currently in violation are required to achieve attainment with the current NAAQS standard by this year."[21] An

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[20] RIA I(B)
[21] RIA Executive Summary

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estimate of the present value of the expected costs of the proposed standard and alternatives, as recommended in President Clinton's guidance regarding economic analysis of federal rules,[22] would be far more informative both for assessing potential costs and for comparing costs with expected benefits.

f) The costs of full attainment are not calculated.

EPA's cost estimates are for partial attainment of the current and proposed standards. One quarter to one-third of the population of the United States lives in areas that are not projected to meet the proposed standard by 2007.[23] Furthermore, the proposed standard is unattainable in many areas for the foreseeable future. In Los Angeles, for instance, even a permanent ban on gasoline-powered automobiles would not bring the area into compliance with the proposed standard.[24]

Our analysis of the full costs of the proposal is presented in Appendix C and highlighted here.

Using EPA assumptions regarding (1) the marginal costs of compliance, and (2) the number of areas that will not attain the standard in 2007 under EPA's partial attainment scenario, we believe that a lower bound on the full cost of attaining the current standard is between $17.7 billion and $65 billion per year. EPA's data suggest that the proposed standard will cost at least an additional $9.1 billion to $83.1 billion each year.

After making adjustments to correct for EPA's understatement of the number of areas out of compliance with the current and proposed standard in 2007, **we estimate that the full cost of attainment will be on the order of $21 billion to $53 billion for the current standard, and additional $54 billion to $328 billion to comply with the proposed standard each year.**[25] To put these costs in perspective, the lower end of the range is greater than the state of Oregon's entire gross state product[26] in 1990. (It was $53 billion.) The combined gross product of all six New England states was $327 million in 1990 — less than the upper bound of this range.[27]

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[22] *Economic Analysis of Federal Regulations Under Executive Order 12866*, January 11, 1996 states, "To the fullest extent possible, benefits and costs should be expressed in discounted constant dollars."
[23] RIA, Table ES-2
[24] See discussion in Appendix C.
[25] The calculations and information used to derive these estimates are described in Appendix C.
[26] Gross State Product (or GSP) is the state equivalent of GNP.
[27] Statistical Abstract of the United States. Table No. 703.

These cost estimates, large as they are, may still understate the impact of the proposed NAAQS because they suggest that the proposed 0.08 ppm standard, is, in fact, attainable. It is not. The true costs of an unattainable standard include the opportunity cost associated with nonattainment, or a decline in the rate of economic growth. Predicting the effect of a regulation on economic growth, and consumption and production opportunities is very difficult to do with any degree of accuracy, and yet it is important that EPA at least recognize the opportunity cost of this proposal. We estimate that a shift in manufacturing establishments to other countries as a result of the large degree of nonattainment expected under the proposal would reduce gross domestic product by roughly $80 billion per year.

D. Recommendations for EPA Action

Based on our review of EPA's RIA, and our own analysis of the benefits and costs of the proposed action, we make the following recommendations.

1. Health benefits are so uncertain that the statute does not compel EPA to revise the standard.

The uncertain scientific basis on which EPA's health effect estimates rest raises serious questions about the advisability of revising the level of the NAAQS at this time. EPA need not rush into a decision based on inadequate information.

- The incremental benefits estimated for the alternative standards are relatively small, and based on an analysis that is fraught with uncertainties.

- The assumptions made in the face of these uncertainties, and how those assumptions affect estimates of benefits, should be articulated more clearly. This is essential if policy makers are to have an adequate basis on which to make decisions regarding appropriate regulatory action, and if the public is to have a meaningful basis for comment.

Given the scientific uncertainty regarding air quality effects of the standards, and the resulting health and welfare impacts, EPA faces a difficult task in attempting to characterize and quantify the effects of alternative standards. However, EPA need not rush into a decision based on inadequate information. The majority of CASAC indicated that a level equivalent to the current standard is protective of public health. In its closure letter, CASAC expressed the opinion that the scientific community is now ready to frame the questions that need to be resolved. It encouraged EPA and the scientific community to continue the research necessary to resolve the uncertainties inherent in the current analysis.

2. EPA's should not proceed with a standard that is likely to *harm* public health and welfare.

The potential impact of a change in the ozone standard on ultraviolet radiation raises serious questions about the net health and welfare effects of this proposal. As proposed, EPA's new standards may actually harm public health and welfare, regardless of costs.

The proposed change in the ozone standard will increase the damage associated with ultraviolet radiation, including malignant and non-melanoma skin cancers, cataracts, and damage to crops and marine organisms. Based on previous analyses conducted by EPA, it appears that these effects could dwarf the positive benefits EPA attributes to the proposed standard.

Our analysis (described in Appendix B) suggests that the net impact on health will be a cost to Americans of $282 million each year. EPA's estimates of the welfare benefits of the proposed standard are approximately halved when UV-B damages are considered. The total impact of attaining the proposed standard would be to increase health risks and welfare damages by $167 million per year. This is particularly disturbing in light of the enormous costs full attainment of this rule would impose on every aspect of our lives.

EPA has a responsibility for setting NAAQS that protect public health and welfare. To fulfill that responsibility it cannot ignore important health and welfare effects which can be readily, and reliably, quantified.

3. EPA's policy judgment should recognize the high costs of the standard and the impact of those costs on public health and welfare.

EPA's estimate of the partial costs of attainment are high, especially relative to benefits. By EPA's own estimates, the costs of partially attaining the proposed standard will exceed the benefits, costing Americans between $1.1 billion and $6.2 billion each year. EPA's consideration of the health and welfare effects of the standard should consider these impacts.

The full costs of attainment are likely to be significantly higher. We estimate that the full cost of attaining the current standard will be on the order of $21 billion to $53 billion per year. An additional $54 billion to $328 billion would be incurred to comply with the proposed standard each year. These enormous costs will take their toll on the health and welfare of the American public, and EPA should recognize that impact in making its policy judgment regarding the level and form of the standard.

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APPENDIX A UNCERTAINTIES IN EPA'S ANALYSIS

There is much uncertainty in the science associated with modeling ozone concentrations and the impact of ozone on public health and welfare. EPA's RIA necessarily makes numerous assumptions in the face of these uncertainties, some of which may have important implications for the resulting estimates of benefits and costs. In this appendix, we highlight the key uncertainties, and the assumptions or approaches EPA has taken to address them.

I. Uncertainties in EPA's Benefits Estimates

As EPA's Clean Air Science Advisory Committee (CASAC), which advised EPA on the scientific foundation for the ozone NAAQS policy, stated: "there are still many gaps in our knowledge and large uncertainties in many of the assessments."[1] The myriad assumptions that have to be made to quantify and then value health and welfare effects necessarily introduce large uncertainties in the results.

The Executive Summary and Chapter IX of the RIA discuss the gaps in EPA's understanding of ozone effects, but assert that limitations in the analysis serve to understate benefits.[2] A review of the RIA and supporting analysis suggests that, while there are factors which may cause benefits estimates to be understated, there are also many assumptions that result in the overstatement of benefits. Both are discussed below.

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[1] CASAC Closure on the Primary Standard Portion of the Staff Paper for Ozone. November 30, 1995.

[2] For example, in discussing the general limitations of the analysis, the Executive Summary states:

> Analyses, and therefore results, continue to be limited by the inability to monetize certain health or welfare benefits - such as protection against loss of lung function, or ecosystem damage. Comparisons of such incomplete benefits to the more quantifiable and usually more complete control costs can be misleading.

This statement is certainly misleading with respect to this particular analysis because the RIA (1) only estimates the direct costs of partially attaining the standard, and (2) omits important categories of costs.

A. Uncertainties and assumptions that might understate benefits

1. Existence of beneficial effects that could not be quantified and valued

The Executive Summary of the RIA suggests that the existence of beneficial effects that could not be quantified and valued cause the benefits of the proposed standard to be understated.[3] EPA's inability to quantify and value some health and welfare effects, all other things equal, could certainly bias benefits downward. This inability is due, in part, to the uncertainty over how (and whether) ozone affects human health and vegetation, as noted in CASAC's review. Unfortunately, given the current state of our understanding, there is little basis for determining whether there are such effects, or, to the extent there are, how significant they are.

2. No estimates for health benefits outside the nonattainment areas

The Executive Summary to the RIA states that:

> While ozone and its precursors can be transported large distances, the health benefits of air quality improvements outside of nonattainment areas (based on controls within those areas) was not assessed which will lead to an understatement of actual benefits.

The effect of not valuing health benefits in attainment areas could understate benefits if imposition of the standard results in air quality improvements in attainment areas. However, recent evidence suggests that when *nonattainment* areas improve to meet the current ozone NAAQS, the air quality in *attainment* areas actually gets worse.[4] Without further analysis, it is not clear what impact the proposed standard will have on air quality and health effects in attainment areas. Given the current state of knowledge, EPA

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[3] "Unmonetized benefit categories include: effects in lung function; unquantified chronic respiratory damage and premature aging of the lungs, sinusitis and hay fever; increased susceptibility to respiratory infection; and protection of Class I areas, forests, ornamental plants, mature trees and seedlings, and ecosystems. Health effects from exposure to toxic air pollutants and reduced mortality and morbidity from fine particles are also not included. The effect of our inability to monetize these benefit categories leads to an underestimation of the monetized benefits presented in this RIA." (Executive Summary)

[4] See discussion under I(B)(1) of this Appendix.

correctly chose a neutral assumption by not attributing health effects (positive or negative) to attainment areas.[5]

3. Choice of baseline may understate benefits

The RIA presents cost and benefit estimates modeled as increments to two baseline scenarios. EPA's preferred baseline (RCS) assumes extensive control strategies are in place by 2007. To the extent this baseline scenario is overly optimistic regarding the controls (and emission reductions) that will be achieved prior to implementation of the current or proposed ozone NAAQS, the benefits of the standards will be understated. In our revised best estimates (see Section III and Appendices B and C of our comments), we have attempted to adjust (partially) for this underestimate in benefits by calculating incremental benefits from EPA's LCS baseline, which assumes fewer controls are in place prior to implementation of the NAAQS standards.

4. Limitations associated with projecting concentrations to 2007

Numerous uncertainties and limitations of the air quality modeling are described in chapters IV and IX of EPA's RIA. It is not obvious in what direction many of these might bias benefit estimates. For example, the Centroid model requires EPA to interpolate on a linear basis between monitored concentrations, and to assume that interpolated concentrations at the center of each county represent concentrations throughout the county. Modeling constraints also force EPA to extrapolate outside the modeled eastern U.S. to the west.

The ANPR addressing implementation of the ozone and particulate matter NAAQS highlights how difficult and complex the modeling of expected ozone concentrations is.

> This "universal" pool of precursors does not imply that reductions of any specific precursor lead to reductions of every pollutant. Just as reductions in NOx potentially can raise local ozone levels, a reduction of a fine particle precursor possibly can increase ozone or increase a different fine particle component (e.g., SOx reductions leading to increased ammonium nitrate, or NOx reductions increasing sulfate formation).

[5] However, policy makers would benefit from a more balanced presentation of the potential implications of this uncertainty on results.

This observation suggests that the projected concentrations are far from certain, and that in fact, concentrations could increase, rather than decrease on application of the modeled controls.

B. Uncertainties and assumptions that might overstate benefits

1. Meteorological conditions

The analysis assumes that meteorological conditions are the same in 2007 as they were in 1987. Ozone levels are heavily influenced by meteorological conditions, particularly temperature, and 1987 was the third hottest year in the U.S. since 1954.[6] As a result, EPA's model may project meteorological conditions in 2007 that are more conducive to ozone formation than would be expected under average conditions. If so, the modeled concentration reductions and resulting estimates of benefits attributable to achieving the standard are higher than they would be if an average year were modeled.[7]

2. Rollback

Chapter IX of the RIA states:

> In this analysis, lack of a national ozone air quality model precludes creating a direct link between the imposition of pollution control equipment (as identified in the cost analysis) and the resulting ambient ozone concentration. Rather, this analysis relies on a rollback methodology that reduces hourly ozone concentrations from two different baselines in the year 2007.

The "quadratic rollback approach" assumes that efforts to reduce ozone concentrations to meet the standard in nonattainment areas during peak hours result in pro-rated reductions in concentrations during off-peak hours. For valuing crop effects, the rollback method is also applied to counties in attainment with the primary standard as necessary to reach compliance with the secondary standard. The rollback equation is constrained such that post-control concentrations for a given hour must always be lower than pre-

[6] National Climatic Data Center, NOAA.

[7] Projections are based on ozone monitoring data from 1990, which was the second hottest year since 1954. However, despite the high temperatures, ozone levels do not appear to have been unusually high in that year. (Trends Report) It is unclear from EPA's discussion what the effect of using 1990 monitoring data might be on the 2007 projections.

control concentrations for that hour.[8] Recent empirical research suggests that EPA's rollback approach to estimating post-control air quality, particularly given this constraint, is likely to overstate air quality improvements during off-peak periods.

Henderson (1996) examines the change in mean *annual* hourly ozone concentrations between 1977 and 1987. He finds that while compliance with the existing ozone NAAQS has caused the variation in annual hourly concentrations to decline significantly, the mean and median has actually *increased* significantly from 1977 to 1987. The implication of these results is that while efforts to reach attainment with the 1979 (1H1EX-120) standard reduced *peak* ozone levels, *average* ozone concentrations were increasing.[9]

Henderson's analysis of EPA monitoring data would suggest that a peak-shaving rollback approach might more accurately reflect the impact of the proposed NAAQS on concentrations across counties.

We recommend that EPA review alternatives to the quadratic rollback method for estimating post-control concentrations. First, however, the Agency needs a better understanding of the effects controls have on ozone concentrations during peak and off-peak periods, and in attainment as well as nonattainment areas. The lack of a national ozone air quality model is a serious impediment to evaluating the potential effectiveness of standards and controls. At a minimum, EPA should evaluate and present for policy makers and the public the impact of alternative rollback approaches on post-control concentrations.

3. Uncertainty in mortality estimates

In explaining the broad range in the estimate of benefits associated with the proposed standard ($4 million to $1.6 billion for partial attainment under EPA's LCS baseline), EPA notes that, "the high estimate of the range includes the results of the mortality category, which comprises greater than 98% of the total estimate...".[10] This estimate of reduced fatalities is based on a single study that was not discussed in the criteria document or staff paper. This study has not been reviewed by EPA's science advisory committee (CASAC). The eleven studies reviewed in the Criteria Document (and by CASAC) either did not find a statistically significant relationship between ozone and mortality or were flawed in important ways. Based on these studies, EPA,

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[8] Mathtech memorandum to Rosalina Rodriguez dated June 8, 1995. "Concentration Data Transformations and the Quadratic Rollback Methodology (Round2, Revised).

[9] Henderson finds that industries that contribute to ozone pollution move from nonattainment to attainment counties, and that nonattainment counties could meet the peak ozone standard without reducing mean or median daily readings, or total emissions.

[10] See table IX-3 of the RIA.

with CASAC's concurrence, determined that the existence of mortality effects was too uncertain to consider in setting the standard.[11]

The weight of the evidence against a causal relationship between ozone concentrations and daily mortality is not clearly presented in the RIA. However, to its credit, EPA does present best (i.e., most likely) estimates of the benefits of the proposed standard. The best estimates do not include benefits associated with reduced mortalities, and range from $9 million to $20 million for partial attainment using the LCS baseline assumptions.[12]

EPA's reliance on a single study that found evidence of mortality effects, despite the existence of at least eleven studies that did not, and despite the fact that this study has not been reviewed by CASAC, is likely to overstate the upper end of the range of estimated benefits.

4. Reliance on CV surveys

The President's Economic Analysis (EA) guidelines observe that some benefits of regulation, such as reductions in health and safety risks, correspond to goods or services that are indirectly traded in the marketplace. For such effects, the guidelines recommend valuation based on the concept of "willingness-to-pay" to avoid the effect, and suggest using "statistical techniques to distill from observable market transactions the portion of willingness-to-pay that can be attributed to the benefit in question."

In this RIA, EPA rejects more accepted valuation approaches based on observable market transactions, including approaches it has used in other analyses, in favor of a contingent valuation (CV) approach. Behavior-based approaches used by EPA in other RIAs include (1) a cost of illness approach, in which the direct and indirect cost of the illness are used to estimate the value of avoiding its incidence, and (2) an averting behavior method, in which expenditures to avoid pollution or its impacts are used as a proxy for willingness to pay.

The inherent difficulties and biases in CV studies have been extensively documented. The President's EA guidelines discourage the use of these methods for effects that are traded directly or indirectly in the marketplace:

> Contingent-valuation methods have become increasingly common for estimating indirectly traded benefits, but the

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[11] The Staff Paper states: "the CD (Sec. 9.6) concludes that although an association between ambient O_3 exposure in areas with very high O_3 levels and daily mortality has been suggested, the strength of any such association remains unclear at this time." (p. 42)

[12] These best estimates are reported only in Appendix E of the RIA, and EPA does not present its best estimates for welfare effects anywhere in the RIA.

> reliance of these methods on hypothetical scenarios and the complexities of the goods being valued by this technique raise issues about its accuracy in estimating willingness to pay compared to methods based on (indirect) revealed preferences.

A panel of economists convened by the National Oceanic and Atmospheric Administration to examine the feasibility of CV methods for valuing "non-use" damages (values which derive from motivations other than personal use) concluded that as no other method exists for estimating non-use damages, CV methods were acceptable, subject to strict study design guidelines. The panel did not condone the use of CV for effects, such as health effects, for which other methods are available. Moreover, the panel raised several concerns with the technique, including:

> (1) the tendency for contingent valuation willingness to pay estimates to seem unreasonably large,
>
> (2) the difficulty in assuring that respondents have understood and absorbed the issues in the survey, and
>
> (3) the difficulty in assuring that respondents are responding to the specific issues in the survey rather than reflecting general warm feelings about public spiritedness or the "warm glow" of giving.[13]

Table A-1 reproduces the values EPA assigns to the health effects of concern (RIA Table IX-2). Consistent with the NOAA panel observation, the values seem unreasonably high. Many of the symptoms valued in Table A-1 are similar to those caused each year by the flu. When stricken by the flu virus, normal, healthy individuals might be expected to experience several days of coughing, acute respiratory symptoms and pain. More susceptible individuals are at risk of more serious effects, including hospitalization and even death.

[13] Tietenberg (1996).

Table A-1[14]

WILLINGNESS-TO-PAY ESTIMATES TO AVOID MORBIDITY AND MORTALITY RISKS (1990 $)

Health Endpoint	WTP Value per Incident		
	Low Estimate	Best Estimate	High Estimate
Cough	$1.26	$7.00	$13.84
Pain Upon Deep Inhalation	$1.26	$4.41	$28.04
Mortality	N/E[15]	$4.8 million	N/E
Hospital Admissions: All Respiratory Illnesses	N/E	$11,972	N/E
Hospital Admissions: Pneumonia	N/E	$15,110	N/E
Hospital Admissions: COPD	N/E	$15,502	N/E
Presence of Any of 19 Acute Respiratory Symptoms	$3.72	$29.33	54.94
Self-Reported Asthma Attacks	$11.81	$32.48	$53.80

Susceptible individuals are encouraged to be vaccinated before the flu season each year, and many probably do. The small cost of the flu vaccine (free to $10) is well worth avoiding the potentially life-threatening virus. Yet, how many healthy individuals are willing to pay this price (which also includes the inconvenience of going to a clinic or doctor's office) to avoid the chance of enduring five days of the type of symptoms valued in this RIA?

For hospital admissions, EPA had only values used in other analyses based on the costs associated with illness. Without an apparent empirical basis, EPA simply doubles these estimates on the assumption that willingness to pay to avoid the admission is twice the cost (direct and lost productivity) of the admission.

Direct behavior/consumer choice measures of the values people attribute to health effects are unequivocally superior to values based on hypothetical

[14] This is a reproduction of RIA TABLE IX- 2
[15] N/E = not estimated

questions. EPA has relied on direct methods in past analyses. If policy makers are to have an unbiased view of the potential benefits of this proposal, and make meaningful comparisons of these benefits to the benefits estimated for other actions, EPA should revise its analysis to use more reliable valuation methods, such as the costs of illness, and lost productivity.

5. Valuation of mortality benefits

As noted above, the benefits associated with reduced mortality from ozone exposure drive the upper bound of EPA's range of benefits. For this analysis, given the weak foundation for any estimate of ozone-caused mortality, we suggest that EPA not include mortality in its benefits analysis. However, as a general matter, we would like to reinforce the recommendations of EPA's Advisory Council on Clean Air Compliance Analysis, which stated:

> We believe that the values applied to statistical lives saved by the CAA should, in principle, reflect the health status of those saved and their remaining life expectancy. We also believe that the value currently applied to a statistical life, $4.8 million (1990 U.S. dollars), significantly overstates the value most people would attach to the average number of life years saved (per person) by the CAA.[16]

The President's EA guidance also suggests that "[a]gencies should consider providing estimates of both VSL [value of statistical life] and VSLY [value of statistical life years], while recognizing the developing state of knowledge in this area."

6. Welfare effects

EPA recognizes the many uncertainties associated with the quantification and valuation of welfare effects (which include benefits attributable to commodity crops, fruits and vegetables.)[17] In its closure letter regarding the secondary standard portion of EPA's analysis, CASAC expresses concern that it did not have adequate information with which to evaluate the appropriateness of EPA's exposure model and extrapolation procedures. CASAC also notes several factors that may overstate the welfare benefits associated with the proposal, including the reliance on open-top chamber studies, which "by their very design and execution produce results that overestimated the effects of ozone on plant yield." In fact, the science panel suggests that the welfare

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[16] October 23, 1996 letter to Administrator Browner.
[17] RIA, Chapter IX(C)(2)(a) last paragraph.

benefits may be so uncertain as to be rendered insignificant. It concludes that EPA's numbers are:

> highly uncertain estimates of crop losses and are a result of a propagation of uncertainties. They are rough estimates, and this should be explicitly stated in this discussion. The Panel believes, however, that these Tables can be of some use in identifying rough relative incremental benefits associated with a given NAAQS *as long as it is recognized that small differences in benefits may have no significance because of these uncertainties.* (emphasis added.)

In addition to affects on commodity crops, fruits, and vegetables, the RIA also suggests large benefits associated with ornamental plants, and commercial forests. These are identified, "to highlight what is at stake from ozone effects."[18] EPA suggests that these impacts are large based on (1) an assumption that 0.5% of retail expenditures on horticulture are caused by ozone damage, and (2) a survey of experts that suggests ozone contributes to a 1% decrease in commercial forest yield. The estimates resulting from these assumptions are hypothetical and lacking in scientific basis. It is appropriate for EPA to have excluded these results from its estimates.

II. Uncertainties in EPA's Costs Estimates

Estimating the cost of this proposed standard is difficult and complex. EPA outlines many uncertainties in the analysis and, throughout the RIA, flags assumptions that have been made that may bias the cost estimates. While EPA directly addresses the issue of simplifying assumptions in the Executive Summary to the RIA, it implies these assumptions necessarily overestimate the costs of the rule. In fact, the biases introduced by having to make assumptions and simplify the analysis serve to both overestimate and underestimate costs.

The discussion below first addresses significant assumptions that may result in an overestimate of cost. The remainder of this section discusses assumptions that may result in an underestimate of cost. To the extent possible, we make adjustments to reflect the magnitude of identifiable biases in Appendix C.

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[18] RIA IX(C)(3)

A. Uncertainties and assumptions that might overstate costs

1. Historical overestimation of control costs

Anecdotal accounts suggest that, historically, estimates of the cost of pollution control technology have been overstated. For example, based on the price of sulfur dioxide emission allowances, electric utilities appear to be reducing emissions at costs significantly lower than predicted. The cause of the overestimation may include reasons cited by EPA in the RIA summary.[19] A recent EPA analysis of estimated vs. actual costs of regulation, however, questioned the conventional wisdom:

> Unfortunately, while the view that ex ante estimated costs nearly always exceed actual compliance costs is widespread, there is very little, if any, documentation of this.[20]

This analysis observes that suggestions that estimated costs tend to be overstated is based on "highly anecdotal" information.

2. Size of non-attainment areas

EPA makes some assumptions that may overstate the number of counties that will be classified as nonattainment, which, in turn, may overstate the costs of reaching attainment. For example, if a county goes out of attainment, EPA assumes the entire C/MSA is out of attainment. However, it is possible for Governors to petition to have the area more limited.[21] It is not clear how large this bias might be, since governors are required to conduct extensive studies to demonstrate to the agency's satisfaction that a portion of the area should be given attainment status.

Also, the analysis classifies entire counties as being out of attainment, even though some C/MSAs may only include partial counties. While this broad brush approach to classifying areas as being out of attainment could overstate the costs of attainment, there may also be scenarios in which this approach

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[19] The Executive Summary to the RIA states:

> these costs may be overstated for many reasons: regulated entities concerned about such costs often overstate their cost projection to support their position; a belief by some analysts that conservative planning requires over-estimation; or an inability to forecast significant improvements in the cost-effectiveness of pollution control that generally occur over analytical periods of five to ten years.

[20] February 6, 1996 memorandum from Frank Arnold, AMI to Alan Carlin, EPA. "Results of Estimated vs. Actual Regulatory Cost Assessment"

[21] See RIA V(B)(1)

understates costs. It is plausible that more cost-effective control strategies might be available when a broader area is considered in the analysis. For example, requiring reformulated gasoline in automobiles for a larger area may be less expensive than imposing additional controls on residual sources of emissions in a smaller area. Depending on how EPA and states actually implement measures to reach attainment, EPA's analytical assumptions could reflect costs accurately, or they could understate or overstate them.

3. Extrapolation of ROM to Western US

EPA's ROM model is its basis for relating emissions inventories to air quality, yet it is confined to the Eastern U.S. EPA uses a patchwork of data, models and expert advice to extrapolate results of the ROM model to the Western U.S. EPA recognizes that "[p]redicting zone concentrations in the West based upon modeled results in the East reduces the reliability of this RIA's results."[22] This introduces large uncertainties which are difficult for reviewers to evaluate.

B. Uncertainties and assumptions that might understate costs

Nowhere in the RIA does EPA estimate the full cost of achieving the level of control it proposes. Since all EPA's cost estimates are for *partial* attainment of the current and proposed standards, they clearly understate the true expected cost of attainment. Moreover, our review of EPA's methodology suggests that EPA has seriously understated even the costs of partial attainment. This section addresses key assumptions and methodological biases that are likely to understate the cost of this proposal.

1. EPA understates the areas that will be out of attainment.

a) EPA uses a standard of 0.092 ppm rather than 0.08 ppm as the standard of attainment.

EPA assumes that areas that can get within 15% of the standard can achieve attainment without any further cost. Effectively, this means EPA is really costing out compliance with a standard of 115% of 0.08 ppm, or 0.092 ppm. This assumption could be extremely significant since 0.092 ppm is even less stringent than the current standard.[23]

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[22] RIA Executive Summary

[23] EPA asserts that "for analytical purposes, the 0.09 ppm alternative is similar to the current 1H1EX-120 standard..." RIA III(A)

It is important to recognize that this assumption does not reflect any change in policy regarding enforcement of the NAAQS. EPA and the states are still required under the act fully to meet the 0.08 ppm standard. Furthermore, no parallel assumption exists in the benefits analysis, which estimates health benefits on the assumption that ambient air concentrations in these areas fully meet the respective standards (not 115% of the standards).

The RIA justifies this assumption on the basis that, currently, areas that exceed the standard by up to 15% are classified as "marginal" non-attainment areas. EPA asserts that such marginal attainment areas can "fix up" their controls over time to achieve attainment at no additional cost.

While it may be true that areas up to 15% over the standard currently fall into marginal non-attainment, this is based on a one-hour standard where, as EPA notes, areas may more readily flip-flop in and out of attainment. Under the proposed 8-hour average concentration standard one would expect the threshold for marginal non-attainment to fall much closer to the actual standard. Areas that are 15% above the standard are much more likely to be in serious non-attainment.

Even if these areas are appropriately classified as marginal non-attainment, EPA's implementation strategy under part 51 of the CAA requires marginal attainment areas to perform six tasks, yet the RIA assigns no costs to these. The six tasks are (1) institute a new source review program, (2) develop an emissions inventory, (3) develop emission statements, (4) establish periodic inventories, (5) institute RACT "fix-ups" and (6) perform I/M corrections.[24] EPA justifies the lack of costs assigned to the first four controls by characterizing them as "small" administrative costs. (See section II(B)(2) of this appendix.) It assigns a zero cost to the "fix-ups" and I/M corrections because the analysis already assumes that these measures are fully effective.

EPA admits this may result in an understatement of the costs but asserts that the "overall impact is small" for two reasons. First, because current rules are already over 95% effective, RACT fix-ups and I/M corrections will not be costly. This appears overly optimistic, as the marginal costs of achieving smaller and smaller increments of emissions reductions can rapidly approach infinity. Second, EPA states that many of these areas will have been marginal nonattainment areas with respect to the current standard, and as they will have been working on improving their performance before 2007, they may achieve compliance prior to the baseline year. As discussed further below, however, the analysis has already assumed that a variety of regional control strategies are in place in its analytical baseline. These controls are thus

[24] RIA V(B)(2)

already accounted for in the baseline air quality estimates that determine which areas will be in attainment.

Finally, even if one were to expect the costs associated with marginal nonattainment to be low relative to the costs for areas in more serious non-attainment, the cumulative cost of many such areas may be significant. Indeed, EPA's analysis shows that EPA expects between 23 and 54 areas to fall into the marginal attainment category under the proposed standard. This represents between 42 percent and 70 percent of all nonattainment areas. (See Tables A-2 and A-3, below.)

We suggest EPA utilize a more realistic threshold for marginal attainment areas under the proposed standard and, for areas that still fall in the marginal attainment category, make some estimate of the administrative and technology costs imposed. Based on the limited data available to us, in Appendix C we make a rough estimate of the impact of this assumption and the one described in the next section.

b) EPA assumes achieving 75% of the necessary pollution reductions is equivalent to achieving full compliance.

In determining the reductions in emissions necessary to achieve compliance with the new standard, EPA uses a modified version of the existing ROM model. This model was used to translate reductions in emissions into ambient concentrations of ozone and vice versa. EPA states that, due to bias in the ROM data sets[25], the model typically overestimates the ambient concentration of ozone based on emissions. That is, ozone concentrations are likely to be lower, and the necessary emissions reduction higher, than the ROM model would predict. To compensate for this, EPA assumes areas need only achieve 75% of the reduction predicted by the ROM model in order to achieve compliance.

However, RIA language suggests that 75% probably overcompensates for the bias in the ROM model. EPA states:

> Based on discussions with EPA modelers and other scientists about the degree of ROM over prediction, agency analysts picked 75% of an area's targeted reductions *as a lower limit* for potential attainment. In other words, for areas which could not meet their standard by applying all available controls. If that area could achieve at least 75% of that target, it could be considered

[25] The RIA doesn't elaborate on what these data biases are. It is possible that they reflect EPA's choice of 1987 (an unusually hot year) as its meteorological baseline.

> 'within the range of uncertainty' and identified as an area of potential attainment. (emphasis added)

Apparently, from the range provided by EPA modelers of the degree to which ROM overestimates ambient concentrations, EPA has selected the "lower bound", rather than using the best estimate of this bias. The analysis assumes that any area within this "range of uncertainty" will be in compliance. This assumption places as many as thirteen additional areas in attainment, when the raw data indicates they would be out of attainment. (See Tables A-2 and A-3)

It is important to note that this assumption does not reflect a policy that enforcement of these regulations will permit counties to achieve only 75 percent of the standard. Also, note that EPA makes no parallel assumption (that concentrations will be only 75% of ROM predictions) in assessing benefits. Such a significant assumption deserves more justification than that which EPA has provided. What, for instance, is the best estimate for the overestimation of the ROM model? At a minimum, EPA should use consistent assumptions regarding concentrations in its benefit and cost analyses.

Tables A-2 and A-3, below, demonstrate the large number of nonattainment areas under the new standard using both the RCS and LCS scenarios and the impact of EPA's assumptions regarding attainment. (The data in Tables A-2 and A-3 are based on information provided in Chapter VI and Appendix A of the RIA.) The second column in each table (labeled "Nonattainment") shows the number of nonattainment areas initially predicted by EPA under the baseline. The third column (labeled "Marginal attainment") shows the number of nonattainment areas that are predicted to be within 15 percent of the standard and thus, according to EPA, are likely to be able to achieve attainment at no additional cost. The fourth column (labeled "Can attain with controls" shows the number of areas initially in nonattainment that can achieve attainment with the application of the pollution control measures in EPA's inventory (listed in Appendix D of these comments). The fifth column (labeled "Within range (75%)") indicates those areas that EPA predicts are initially in nonattainment but can achieve attainment at no additional cost because they are estimated to achieve at least 75 percent of the necessary reductions to reach attainment.

Table A-2
Regional Control Scenario (RCS)

Standard	Nonattain-ment	Marginal attainment (15%)	Can attain with controls	Within range (75%)	Residual Nonattain-ment
1H1EX-120 (current std)	20	14	0	0	6
8H4AX-80 (less stringent than proposal	37	23	1	1	12
8H1AX-80 (more stringent than proposal	75	35	3	13	24

Table A-3
Local Control Scenario (LCS)

Standard	Nonattain-ment	Marginal attainment (15%)	Can attain with controls	Within range (75%)	Residual Nonattain-ment
1H1EX-120 (current std)	27	17	1	0	9
8H4AX-80 (less stringent than proposal	68	38	3	6	21
8H1AX-80 (more stringent than proposal	129	54	17	12	46

c) Centroid model

EPA recognizes that its "Centroid" model may under predict the true degree of nonattainment due to the scarcity of monitors in existence in 1990, the base year used in the model.[26] Unlike the bias created by the over estimation of ozone levels predicted by the ROM model, EPA does not attempt to compensate for this bias. The RIA provides no basis on which to correct this underestimate, so we have made no adjustment for it in our revised cost estimate.

[26] IV(C)(5)0

2. EPA's estimate omits important categories of costs.

EPA estimates the direct costs necessary for a portion of the modeled nonattainment areas to reach partial attainment with the standard. In addition to assigning no costs to areas misclassified as reaching attainment, as discussed above, the RIA ignores several other categories of costs.

- The RIA ignores the health and welfare costs of revising the ozone standard. These costs include risk-risk and health-health tradeoffs. One important category of health and welfare costs not considered derives from the fact that tropospheric ozone disperses ultraviolet-B radiation and reduces the adverse effects of UV-B rays. This is quantified in Appendix B.

- The costs to Federal facilities to comply with the proposed standard are not addressed by the RIA.

- The administrative costs incurred by Federal, State and local levels of government, as well as regulated entities are not valued in this RIA.

- Opportunity costs, such as the impact of new source review programs on economic growth, are not addressed. The President's economic analysis guidelines state:

> The preferred measure of cost is the "opportunity cost" of the resources used or the benefits forgone as a result of the regulatory action.[27]

3. EPA's baseline includes costs that are better characterized as incremental.

All EPA's cost estimates (for achieving the current ozone NAAQS as well as the proposed alternatives), are incremental to a baseline in 2007. The definition of this baseline strongly influences the cost estimates, because the cost of emission reductions that are attributed to the baseline do not appear as incremental costs of either the current standard nor the proposed standard.

In deriving the baselines, EPA is optimistic about future reductions in ozone concentrations due to full and rigorous implementation of existing and proposed regulations as well as the implementation of discretionary control measures. The greater the assumed reductions in pollutants caused by other regulations and discretionary actions, the lower the estimates of costs

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[27] *Economic Analysis of Federal Regulations Under Executive Order 12866*, January 11, 1996 (III(C)(1))

necessary to meet the proposed standard. Thus, to the extent EPA overestimates the effectiveness of other regulations and discretionary measures in its baseline, the costs of this new standard will be underestimated. There is reason to believe EPA's analytical baseline includes (1) overestimates of the effectiveness and implementation of new regulations put in place prior to 2007 and (2) emission reductions from actions that in fact are related to the current and proposed ozone NAAQS.

a) Impact of existing and proposed regulations on baseline concentrations

EPA assumes a reduction in VOC emissions of 6.3 million tons per year by 2007. Over half of this reduction (56%) is attributable to two initiatives: the implementation of maximum achievable control technology (MACT) standards under Title III of the CAA, and hazardous waste treatment storage and disposal facility (TSDF) regulations.

The RIA suggests that the estimates of MACT emissions may be overstated for two reasons: (1) "many nonattainment areas may already have standards equivalent to MACT" and (2) "reductions in non-attainment areas may be overestimated if the SIP requirements are already as stringent as the MACT standards will be."[28] Thus to the extent nonattainment areas already have installed MACT equivalents, EPA's assumption double counts emissions reductions in the baseline. This results in an underestimate of the incremental cost of achieving more stringent standards.

The other major rule contributing to baseline emission reductions is the TSDF rule. EPA assumes this rule will reduce VOC emissions by 1,741,000 tons each year. This reduction alone accounts for nearly a third of the additional VOC reductions projected for the year 2007. While EPA does not cite the source of this estimate, it appears to come from the draft RIA supporting EPA proposed RCRA Air Emissions Standards which was issued in August of 1989. This draft RIA estimates the proposed controls on TSDFs would result in annual reductions in VOC emissions of 1,704,000 Mg or approximately 1,740,000 tons a year.[29]

Primarily because it is based on a mistaken estimate of the quantity and types of wastes TSDFs manage, this estimate is a gross overstatement of the actual reductions the TSDF rule would achieve. In response to comments on the proposed rule and RIA, EPA revised the estimate of VOC reductions

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[28] IV(B)(1)(C)

[29] EPA, Office of Air Quality Planning and Standards, "Draft Hazardous Waste Treatment, Storage, and Disposal Facility Regulatory Impact Analysis for Proposed RCRA Air Emissions Standards." August 1989. Table VII-1, p. VII-7. Estimate includes and additional 73,000 Mg per year attributable to controls on 90 day tanks.

attributable to the TSDF rule in 1994.[30] This revision reduced the estimated VOC reductions by approximately 40 percent to 1,043,000 Mg per year or just over a million tons per year. Thus the baseline used in the RIA for the revised Ozone NAAQS attributes over 700 thousand tons of annual reductions in VOCs to the TSDF rule that EPA has subsequently determined it will not achieve. The cost of achieving these reductions should be added to the cost of the ozone rule rather than being assigned to the baseline.

As for NOx reductions, EPA assumes new rules unrelated to the proposed NAAQS will reduce emissions by 8.3 million tons a year. RACT (reasonably available control technologies) controls on utilities account for 40 percent of the NOx emission reductions. RACT controls and lowest achievable emission rate (LAER) controls are applied to all major sources in nonattainment areas and the ozone transport region. LAER requirements are assumed to limit emissions for new and modified coal fired and oil or gas fired utility combustion units in these areas to 0.10 lb. NOx/MMBtu and 0.05 lb. NOx/MMBtu, respectively. Control Development Technology (CDT) under Title IV of the CAA, accounts for an additional 40 percent of EPA's baseline NOx reductions. CDT is not discussed in the document, so it is difficult for commentors to evaluate this assumption. It is interesting to note that EPA recently claimed Title IV NOx controls on utilities will result in a total of 2 million tons of reduced NOx emissions in the year 2000.[31] Because the ozone RIA does not elaborate on EPA's claimed 3.3 million tons of Title IV CDT reductions in the year 2007, it is unclear how this estimate relates to the 2 million tons documented in EPA's other rulemakings.

b) Impact of discretionary measures in RCS baseline

EPA presents all its costs estimates as incremental to two baselines, labeled RCS and LCS. As noted in Section III, EPA prefers the less costly RCS baseline, which assumes that discretionary regional controls will be in place, and considers the LCS baseline to be an upper bound on the costs. The difference between the two baselines is that RCS includes a 0.15 pounds per million BTU cap on NO_x emissions from utilities and other combustion boilers, and a California-style low emission vehicle (LEV) program applied to each county in the 37 eastern states. EPA estimates the cost of a national LEV program at over $600 million/year, and the cost of the 15 pound per million BTU NOx cap at $2.3 billion in the year 2007.[32]

The RIA states, "[t]he staff believes that these [regional NOx] efforts will be in place in the year 2007, and because they are being undertaken to attain the

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[30] EPA, Office of Air Quality Planning and Standards, "Hazardous Waste Treatment, Storage, and Disposal Facilities Background Information Document," November 1994, p. 1-12.
[31] See 61 FR 67120, December 19, 1996.
[32] RIA VI(B)(1)

current ozone NAAQS, they should be included in the analytical baseline of this RIA."[33] Yet, by including these in the baseline, their costs are not attributed to the cost of meeting the current ozone NAAQS. This clearly understates the costs of meeting the current standard by $2.9 billion per year (the sum of the costs of the two programs that are excluded from the estimate of incremental costs).

Though EPA bases its RCS on regional strategies expected to be applied by OTAG (the Ozone Transport Assessment Group, representing the 37 Eastern-most States and DC), it admits that "[i]n every case but the most extreme, the OTAG strategies represent a lower level of control than that included in this RIA."[34] In other words, not only does EPA take credit for emission reductions without including their costs, it is optimistic about the emission reductions that are achieved in this RCS baseline.

Although EPA refers to the RCS as its "analytical baseline," and the LCS as "sensitivity analysis," emission reduction targets for the RCS are not modeled separately. Rather EPA establishes emission reduction targets to meet standards under the LCS and then assumes that regional control strategies would improve air quality by 12% across the board.[35]

Due to the number of controls assumed in the baseline, the lack of information provided in the RIA for many of them, and the varied assumptions involved in estimating costs and emission reductions, it is difficult for an observer to extract from the baseline the costs and emission reductions that more properly belong in an estimate of the incremental effects of the current and proposed standards. However, due to (1) the discretionary nature of the controls assumed under the RCS baseline, (2) the uncertainty and likely overstatement of emission reductions assigned to those controls, and (3) EPA's recognition that those controls will be undertaken to comply with the current ambient ozone standard, we suggest that, at a minimum, EPA abandon the RCS as its baseline, and adopt the LCS baseline for its analysis of costs and benefits of the proposal.

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[33] RIA IV(B(3)

[34] RIA V(B)

[35] EPA's sensitivity analysis revealed no change in cost under the most stringent scenario if it used a 6% rather than a 12% adjustment factor to estimate RCS costs, because the areas classified as residual nonattainment areas using the 12% adjustment factor had already exhausted their inventory of identified controls. Three marginal nonattainment areas would be classified as nonattainment using the 6% adjustment factor, but, as they also had exhausted their control inventory, the RIA assigned no costs to them. In other words, the costs of partial attainment do not change (because it is constrained), but the degree of nonattainment increases. RIA V(C)

4. The RIA presents estimates of costs (and benefits) for a single year: 2007.

The RIA presents costs for a single year (2007). EPA selected 2007 because by then it expects "most of the mandatory CAAA requirements will have fully taken effect and most areas currently in violation are required to achieve attainment with the current NAAQS standard by this year."[36] However, EPA's "snapshot" approach that is based on air quality modeling for a single representative year has drawbacks. The Executive Summary to the RIA mentions one of these limitations—that due to technological change and other factors between now and 2007, the costs of meeting the standards may be lower. EPA's analysis indirectly addresses this issue in several ways. First, the RIA truncates its inventory of possible controls at a per-ton cost of between $30,000 and $80,000. The analysis also assumes greater emission reductions will be achieved from certain controls than is currently feasible.[37] Moreover, as noted above, the analysis also assumes that areas that are modeled to come within 64 percent (75% of 85%) of attaining the standard will be able to meet the standard at no additional cost.

The RIA does not address a corresponding problem with the snapshot approach: that it does not recognize the effect that economic and population growth beyond the year 2007 will have on attainment status and the costs of compliance with these standards. As recognized in the President's guidance regarding economic analysis of federal rules, discounted costs are more informative both in assessing potential costs and in comparisons with expected benefits. The President's guidance states:

> "To the fullest extent possible, benefits and costs should be expressed in discounted constant dollars."[38]

In its analysis, EPA projects growth in emissions as a function of manufacturing earnings per capita, and population growth, as well as other variables, including attainment status and emission controls put in place between 1990 and 2007. Because EPA's baseline assumes available cost-effective controls are in place, its model actually projects a decline in ambient air concentrations by 2007. (That is, the rate of decrease in ozone concentrations due to the CAA and other control measures will be greater than the rate of increase due to economic growth.) This will not be expected to be the case beyond 2007 (or the extent to which it is will be attributable to the proposed standard). Therefore, providing an estimate of the *present value* of the costs and benefits of this rule would be informative. Benefits

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[36] RIA Executive Summary
[37] RIA VI(B)
[38] *Economic Analysis of Federal Regulations Under Executive Order 12866*, January 11, 1996

might be expected to grow at the population rate, while costs would be expected to grow at a faster rate of population times manufacturing earnings per capita.

Once EPA has calculated present values for the costs and benefits of each alternative, it would be acceptable to convert those to annualized costs for purposes of exposition and comparison. Annualized costs are a valid measure when calculated properly. It is important to recognize, however, that EPA's snapshot approach of estimating benefits and costs for a selected year, is not an accepted method of estimating costs and benefits.[39]

[39] The Presidents EA guidance recognizes this: "When the effects of alternative options are measured in units that accrue at the same time that the costs are incurred, annualizing costs is sufficient and further discounting of non-monetized benefits is unnecessary; for instance, the annualized cost per ton of reducing certain polluting emissions can be an appropriate measure of cost-effectiveness. However, when effects are measured in units that accrue later than when the costs are incurred, such as the reduction of adverse health effects that occur only after a long period of exposure, the annualized cost per unit should be calculated after discounting for the delay between accrual of the costs and the effects." Ibid., Section III(A)(3) (General Principles)

III REVIEW OF EPA'S REGULATORY ANALYSIS

In this section, we review the regulatory impact analysis (RIA) EPA has prepared for the proposed revision to the ozone NAAQS. EPA's own analysis of the benefits and costs of the proposal provide some startling conclusions, including (1) the costs of the rule are significantly greater than the benefits, and (2) many communities will find themselves unable to comply with the standard for the foreseeable future, even after bearing these considerable costs.

There are major flaws in the approach and assumptions used in the RIA. After adjusting for these flaws, we find that the net benefits of this proposal are even smaller than EPA's RIA predicts, and that, in fact, implementation of the proposal is likely to harm public health and welfare.

In section A, below, we summarize the major conclusions of (1) EPA's own analysis, and (2) our analysis of the benefits and costs of the proposal. In section B, we summarize the approach used in the RIA to estimate benefits and costs. In section C, we critique EPA's methodology and present the results of our analysis of the full impact of the proposal. We summarize our conclusions in section D.

A. Conclusions Regarding the Impact of EPA's Proposal

1. EPA's own regulatory analysis finds that the costs of the proposal exceed the benefits.

EPA expects partial compliance with the proposed standard to impose net costs (i.e., costs in excess of benefits) on Americans of between $1.1 billion and $6.2 billion each year. These net costs are over and above EPA's estimates of the annual net cost of partially complying with the existing standard, which is considerable—EPA estimates the costs of partially meeting the current standard will exceed benefits by between $400 million and $2.2 billion per year.

EPA anticipates a large degree of nonattainment. The number of areas unable to meet the standard remains large even after EPA (1) assumes all feasible control measures will be applied, and (2) classifies many areas that are modeled to be out of attainment as being able to achieve attainment. (These issue is discussed and analyzed in Appendix C.) Even with no change in the NAAQS, EPA estimates that between 39 million and 57 million people will live in non-attainment areas, and the agency does not describe how these

areas will achieve attainment. An additional 14 million to 32 million people would live in non-attainment areas under the proposed revised standard.[1]

Questionable assumptions lead to an understatement of costs. The assumption that regional controls will be put in place by 2007, and that the costs of those controls are not attributable to the current or proposed ozone NAAQS, significantly affects the cost estimate. When EPA assumes implementation of a regional control strategy as its baseline, estimates of the annual costs of partially meeting the standard are between $630 million and $2.5 billion. EPA's cost estimates more than double (to between $2.2 billion and $6.3 billion) when EPA assumes a local control strategy (LCS) baseline. Benefits are also influenced by the choice of the baseline, although not as dramatically.

EPA's benefit estimates are uncertain, and EPA places its own best estimates at the low end of its range. Modeling, exposure, and valuation constraints make EPA's benefit estimates very uncertain. CASAC observed that due to the compounded uncertainties in the approach to estimating welfare effects, "small differences in benefits may have no significance..." EPA's best (i.e., most likely) estimate of the incremental health benefits of the proposed standard is at the low end of its range, between $11 million and $108 million.[2]

The estimated benefit of reduced mortality, not the other health benefits EPA relies on to support its proposal, dominate its estimate of benefits. In explaining the broad range in the estimate of health benefits associated with the proposed standard, EPA notes that, "the high estimate of the range includes the results of the mortality category, which comprises greater than 98% of the total estimate..."[3] As discussed below, this estimate of reduced fatalities is based on a single study that was not discussed in the criteria document or staff paper, and thus not reviewed by EPA's science advisory committee (CASAC).

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[1] RIA Tables ES-2 and ES-3

[2] Note that EPA's *best estimates* of the total health benefits do not include mortality benefits. The low end of the range, $11 million, is based on the epidemiological approach, an 0.08 ppm, 8-hr, 4 exceedance standard, and the regional control scenario. The upper end of the range, $108 million depends on a clinical approach, local control strategy assumptions and an 0.08 ppm, 8-hr, 1 ex standard. (RIA Table E-22, E-23, E-25, E-26, E-28, E-29) The mean of the best estimates across 1 and 4 exceedance standards, clinical and epidemiological approaches, and RCS and LCS is $42 million. EPA does not report best estimates for welfare benefits.

[3] See table IX-3 of the RIA.

2. Correcting for biases and omissions in EPA's analysis, the negative health and welfare impacts of the proposal are even clearer.

EPA's proposal may *harm* public health and welfare, regardless of cost. The potential impact of a change in the ozone standard on ultraviolet (UV-B) radiation raises serious questions about the net health and welfare effects of this proposal. **We estimate that the total impact of attaining the proposed standard would be to increase health risks and welfare damages by over $100 million per year.** This is particularly disturbing in light of the enormous costs full attainment of this rule would impose on every aspect of our lives.

The full costs of meeting this standard are significantly higher than EPA's estimated costs of partial attainment. The full cost of attaining the **current** standard is likely to be between $22 billion and $53 billion per year. The proposed standards are estimated to impose additional costs in the range of $54 billion to $328 billion per year (in 1990 dollars).

The incremental benefits estimated for the alternative standards are relatively small, and based on an analysis that is fraught with uncertainties. The uncertain scientific basis on which EPA's health effect estimates rest raises serious questions about the advisability of revising the level of the NAAQS at this time.

B. Summary of EPA's RIA

EPA has determined that the proposed rule is a significant action as defined by Executive Order 12866. Accordingly it has prepared a draft RIA to accompany the rule. However, in accordance with EPA's interpretation of statutory prohibitions, "[n]either the draft RIA nor the associated contractor reports have been considered in issuing this proposal."

This section of our comments summarizes the methodology employed in the RIA for estimating the benefits and costs of the proposed rule and its results.

1. Summary of EPA's methodology for estimating benefits.

EPA is required under E.O. 12866 to evaluate the benefits of proposed regulatory actions. Chapter IX of its RIA addresses this requirement.

a) Alternatives examined

Although the Executive Order requires EPA to evaluate the impact of the proposal, it fails to do so. EPA estimates the benefits of four alternative standards, none of which is the proposed standard nor the two alternatives

APPENDIX B OZONE'S IMPACT ON ULTRAVIOLET RADIATION

Ozone (both in the stratosphere and in the troposphere) affects the dispersion and penetration of ultraviolet B (UV-B) radiation. Reductions in ground-level (tropospheric) ozone as a result of a revised ambient ozone standard will cause total column ozone to decrease, increasing the penetration of UV-B rays.

The last paragraph of EPA's RIA states that "no attempt to quantify this potential effect, which is expected to be small, has been made in this analysis." However, a review of EPA's analysis of UV-B effects (for this rule and previous rules) indicates that the negative health benefits (or health costs) associated with the UV-B effects of the proposal could exceed the annual health benefits EPA attributes to ozone reductions by over $280 million. EPA also suggests that uncertainty in the UV-B estimates makes them indefensible, however, the benefits EPA estimates in the ozone NAAQS RIA arguably are founded on much weaker science and modeling.

In this appendix, we attempt to quantify and value the harmful effects of the increase in UV-B radiation that would result from the proposed change in the ozone NAAQS. Our analysis is based solely on methods, models and data used by EPA in previous analyses of the benefits of reducing chemicals that affect stratospheric ozone. In section I we present our approach to estimating the health impacts of an increase in UV-B, and in section II we present our approach to estimating the welfare impacts.

I. Approach to estimating health impacts

To quantify and value the potential impact of the proposed standard on increased penetration of UV-B radiation, several steps are involved.

- Determine the effect changes in ambient ozone concentrations have on total column ozone. (UV-B penetration of the atmosphere and its associated health and welfare effects are a function of total column ozone.[1])

- Quantify the relationship between change in total column ozone, UV-B penetration, and health or welfare effects. (This is the dose-response relationship.)

[1] See Cupitt white paper and Frazier statement before CASAC.

- Apply the dose-response function to the population exposed to increased UV-B.

- Assign values to the estimated health and welfare effects.

In each of these steps, we relied on information provided in EPA documents, as described below.

A. Impact on total column ozone of proposed NAAQS

We assume that EPA's proposed NAAQS will result in approximately a 0.5% reduction in total column ozone. This assumption is based on the following:

- EPA asserts in the RIA to this rule that the current 0.12 ppm one-hour standard is roughly equivalent to a 0.09 ppm 8-hr standard. Thus, a change to a 0.08 ppm 8-hr standard represents approximately a 10 ppb decline in ozone concentrations.[2]

- In a white paper prepared as background for this rulemaking, EPA estimates that a 10 ppb decline in regional scale ozone concentrations will translate to a 0.3% to 0.5% decline in total column ozone during the ozone season and a 0.5% to 0.8% decline in total column ozone during ozone episodes.[3]

B. Health effects

EPA has quantified the relationship between total column ozone, UV-B exposure and several health effects.[4] Previous EPA analyses have developed dose-response relationships for two types of nonmelanoma skin cancer (NMSC)—basal cell carcinoma and squamous cell carcinoma, as well as malignant melanoma, and cataracts.

In a statement before CASAC by Marvin Frazier in March 1995, the Department of Energy (DOE), used EPA's dose response data to estimate new cases of (1) NMSC, (2) cutaneous melanoma, (3) melanoma-caused deaths, and (4) cataracts attributable to a 0.5% decline in total column ozone.[5] In a

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[2] Because the NAAQS are likely to decrease peak concentrations rather than average concentrations, this may overstate the total column ozone change in attainment areas and during off-peak seasons. To do this analysis properly, EPA should apply models consistent with its approach to modeling ambient ozone concentrations.
[3] Cupitt, pp. 7-8
[4] EPA (1987)
[5] The DOE estimates are based on EPA's 1987 report, "Assessing the Risks of Trace Gases that Can Modify the Stratosphere." This report is also the basis for the dose-response functions used in the stratospheric ozone RIA.

white paper prepared for this rulemaking, EPA (Cupitt) estimated a narrower range for the likely increase in NMSC cases in the eastern United States attributable to tightening the ozone standard by 10 ppb.[6]

Estimates of the new cases for each of these effects are presented in columns 2 and 3 of Table B-1 below.

C. Valuation of health effects

In its RIA for the Phase-out of ozone depleting chemicals (stratospheric ozone RIA), EPA values each of the identified nonfatal health effects as the sum of the costs of treatment and lost production. That RIA assigns values ranging from $3 million to $12 million for melanoma-caused deaths. These values are all in 1985 dollars. We use these estimates of the costs-per-case of these health effects to value the negative health benefits resulting from the ozone NAAQS. These values (adjusted to 1990 dollars using a GDP deflator of 1.19) are presented in columns 4, 5, and 6 of Table B-1.

D. Negative health impact of proposed standard

Table B-1 below presents our rough estimates of the negative health consequences of the proposed revision to the ozone standard. In evaluating these estimates, several points are worth noting.

- These estimates are based on the information, assumptions, and methodologies used by EPA in its regulatory actions addressing stratospheric ozone.

- The values used here (and in the stratospheric ozone RIA) are based on the costs of illness and lost productivity. The ozone NAAQS RIA relies on higher CV values when available, and doubles values derived from cost of illness and lost productivity approaches. Therefore, in comparisons with ozone-related health effects, our UV-B-related health effects are understated.

- As the best estimate within the range of benefits attributable to premature death, we relied on the $4.8 million EPA uses for the value of a death avoided in the NAAQS RIA. This figure is used to facilitate comparisons of the positive and negative health effects of the proposed standard, not as an endorsement of that value.

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[6] EPA estimated a range of 3,300 to 4,500 for the eastern U.S. compared to DOE's estimate of an increase of 2,000 to 11,000 NMSC cases for the entire country.

- The estimated changes in ozone concentration resulting from the proposal may be overstated. These could be made more compatible with EPA's estimated benefits of ozone reductions if EPA applied the same concentration modeling and assumptions.

- In an effort not to overstate the potential negative impact, our *best* estimates rely on the *lower bound* number of cases, and EPA's best estimate of value per case.

- Our estimates do not include other less readily quantified health effects of UV-B exposure. According to the stratospheric ozone RIA, "serious potential effects [of UV-B] are depression of the immune system and increased incidence of actinic keratosis [pre-cancerous lesions]."

Table B-1
Negative Health Benefits of Ozone NAAQS

Health Effect	New Cases due to .5% decline in total column O_3		Cost/case (1990$)			Benefits (in millions of 1990 $)		
	Lower	Upper	Lower	Best	Upper	Lower	Best	Upper
Nonmelanoma skin cancer	2,000	11,000	$4760	$6,545	$8,330	$9.5	$13.1	$91.6
cutaneous melanoma	130	260	$17,850	$17,850	$17,850	$2.3	$2.3	$4.6
melanoma caused deaths	25	50	$3,570,000	$4,800,000	$14,280,000	$89.3	$120	$714
cataract cases	13,000	28,000	$17,850	$17,850	$17,850	$232.1	$232.1	$500.0
Negative benefits in millions 1990$[7]						**$333**	**$367**	**$1310**

In Appendix E to the ozone NAAQS RIA, EPA reports best (most likely) estimates of health benefits for different standards, control strategies and methodologies. The mean of these (for the LCS baseline and the two standards that bound the selected standard) is $86 million.[8] Subtracting our best estimate of the negative health benefits associated with the increase in

[7] Using EPA's estimate of NMSC cases, negative benefits of the rule range from $255 million to $1,255 million with a best estimate of $399 million.
[8] We rely on the LCS baseline because the RCS baseline is likely to understate the benefits of achieving the alternate standards as discussed in III-C above.

UV-B radiation ($367 million), we estimate that the proposal could result in negative health benefits of $282 million.[9]

II. Approach to estimating negative welfare impacts

The RIA supporting EPA's phase-out of ozone depleting chemicals quantifies and values three categories of welfare effects attributable to increased UV-B: depletion of commercial fisheries, damage to commodity crops, and damage to polymers. Time constraints imposed by the short comment period prevented us from using a direct dose-response approach to quantifying welfare effects, as we did for health effects above. Instead, we attempted to scale the benefits estimated in the stratospheric ozone RIA to reflect the smaller change in total column ozone associated with the proposed ambient ozone standard. Our resulting estimates are very rough. EPA has the necessary data and methodology to make more direct estimates of the welfare effects, and it should do so before making a final decision on the ozone NAAQS.

A. Commercial fisheries

We estimate the annual cost to commercial fisheries associated with the proposed ozone NAAQS will range from $1.1 million to $61.6 million (1990$). This rough estimate is based on the approach outlined below.

- The stratospheric ozone RIA estimates that the reduction in ozone depleting chemicals necessary to comply with the 1987 Montreal Protocol will achieve benefits to commercial fisheries ranging from $2.8 billion to $11.2 billion, with a best estimate of $5.6 billion.[10] This is a present value, stated in 1985 dollars.

- We put these present value benefits on an annual basis using the 2 percent discount rate used in that RIA. The resulting annual low, best and high estimates for complying with the Montreal Protocol are $.07 billion, $0.13 billion, and $0.27 billion, respectively.

- We converted these values to 1990 dollars using a GDP deflator of 1.19.

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[9] Refer to Table 4 of Section III of these comments.

[10] The stratospheric ozone RIA Ex. 6-8, p. 6-31 presents the changes in value of fish harvest by 2075.

- The percent change in column ozone used to calculate these Montreal Protocol benefits ranges from 2.6 percent in 2025 to 35.7 percent in 2075.[11]

- The proposed change in the ozone NAAQS is expected to result in a 0.5 percent reduction in total column ozone, as described above in V-A-1. We divide the percentage change in total column ozone associated with the proposed NAAQS by the percentage total column ozone change estimated in the stratospheric ozone RIA for meeting the Montreal Protocol to derive a scaling factor.

- We apply this scaling factor to the total benefits estimated in the stratospheric ozone RIA for meeting the Montreal Protocol to estimate the range in possible negative benefits associated with the NAAQS. Thus, we estimate the proposed NAAQS will have negative benefits that range between 1.4 percent and 19 percent of the commercial fishing benefits calculated for the stratospheric ozone rule. The midpoint of this range is 10.3 percent.

- The total annualized value to commercial fisheries estimated for the Stratospheric ozone rule is $70 million to $130 million. We multiply these figures by our range of scaling factors to estimate annual fishery damage (negative benefit) from the proposed NAAQS in the range of $1.1 million to $61.6 million. Our best estimate of the damage to commercial fisheries is $16.5 million per year.

B. Commodity crops

We apply the same scaling factors to EPA's estimates of the benefits to commodity crops from the reductions in ozone associated with the Montreal Protocol.

- The stratospheric ozone RIA credits compliance with the Montreal Protocol for reducing damages to commodity crops. The present values of these benefits range from $11.5 billion to $46.2 billion, with a best estimate of $23 billion.[12] These figures are in 1985 $.

- We put these present value benefits on an annual basis using the 2 percent discount rate used in the stratospheric ozone RIA. The resulting annual low, best and high estimates of meeting the Montreal Protocol are $.28 billion, $0.55 billion, and $1.11 billion, respectively.

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[11]The stratospheric ozone RIA Ex. 5-5, p. 5-14 presents the percent ozone depletion expected in future years under a scenario of no controls, and with various Phase-out scenarios. We used percentages and benefits associated with the "1987 Montreal Protocol scenario."
[12] Stratospheric ozone RIA Ex. 6-9.

- We multiply these figures by our scaling factors to estimate commodity crop losses attributable to the proposed ozone NAAQS. After converting to 1990 dollars, losses range from $4.6 million to $254.2 million. Our best estimate of the damage of the proposed rule to commodity crops is $67.9 million.

C. Polymer damage

EPA also estimates the cost of mitigating damages to polymers caused by UV-B in its stratospheric ozone RIA. Using the scaling approach described above, we estimate the polymer damage attributable to the increase in UV-B that might be expected from the proposed ozone NAAQS.

- According to the stratospheric ozone RIA, achieving the Montreal Protocol will produce benefits associated with reducing polymer damage that range from $1.4 billion to $5.7 billion, with a best estimate of $2.9 billion.[13] These figures are in 1985 $.

- We put these present value benefits on an annual basis using the 2 percent discount rate used in the Stratospheric ozone RIA. The resulting annual low, best and high estimates of meeting the Montreal Protocol are $34 million, $69 million, and $137 million, respectively.

- We multiply these figures by our scaling factors to estimate the polymer damage attributable to the proposed ozone NAAQS. After converting to 1990 dollars, losses range from $0.6 million to $31.4 million. Our best estimate of the polymer damage of the proposed rule is $8.4 million.

Table B-2 summarizes the welfare impacts attributable to the increase in UV-B associated with the proposed change in ambient ozone concentrations. These are rough estimates, derived by scaling the benefits EPA has attributed to total column ozone reductions achieved by the Montreal Protocol to reflect the total column ozone reductions expected from the proposed NAAQS. EPA has the data and methods to conduct a more robust assessment of these welfare effects, and it should do so before making a final decision on the appropriate ambient ozone standard.

[13] Stratospheric ozone RIA Ex. 6-9.

Table B-2
Negative Welfare Benefits of Ozone NAAQS
(Millions of 1990 dollars)

Welfare Effect	Lower	Best	Upper
Commercial Fisheries	$1.1	$16.5	$61.6
Commodity Crops	$4.6	$67.9	254.2
Polymer Damage	$0.6	$8.4	$31.4
Negative Welfare Benefits	**$6**	**$93**	**$347**

APPENDIX C THE FULL COSTS OF ATTAINMENT

In its RIA for the proposed revision to the ozone NAAQS, EPA estimates the costs of *partially* attaining the current and proposed standard. EPA recognizes that its estimates of costs are unreliable for comparison among alternatives. The incremental costs of more stringent alternatives appear small, but, as EPA notes, that is "an artifact of the maximal application of control measures within areas which experience residual nonattainment."[1] Recall that, even after application of all known control measures, many areas do not comply with the *current standard*, so while tightening the standard has the effect of increasing the number of areas that cannot comply, it does not increase EPA's estimate of partial compliance costs because additional control measures are simply not available. **As a result, EPA states "aggregate total costs underestimate the true cost of each alternative to such an extent that the metric's reliability must be limited."**[2]

While EPA does not estimate the full cost of attaining the current standard and the proposed alternative, it does provide information in the RIA that allows one to calculate a lower bound on these costs. In this appendix, we use three different methods to estimate the full cost of attainment. In section I, we calculate full costs using EPA's estimates of (a) the marginal costs per ton of emissions reduced and (b) residual tons of pollutants. In section II, we correct for biases in EPA's estimates of the residual tons of pollutants that would have to be removed to comply. We believe this provides a more realistic estimate of the cost of full attainment. In section III, we recognize that many areas will not be able to comply with the standard at any cost, and examine the opportunity costs associated with nonattainment status.

The estimates below all rely on EPA's local control strategy (LCS) baseline. As discussed in Section III and Appendix A of these comments, we believe the LCS baseline reflects expected costs better than EPA's regional control strategy (RCS) baseline, due to (1) the discretionary nature of the controls assumed under the RCS baseline, (2) the uncertainty and likely overstatement of emission reductions assigned to those controls, and (3) EPA's recognition that those controls will be undertaken to comply with the current ambient ozone standard.

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[1] RIA, VI(C)
[2] RIA, VI(C)

I. Full costs using EPA estimates of nonattainment

EPA notes that:

> [t]he marginal cost associated with the most expensive current control approaches might be a starting point for evaluating residual nonattainment. . . . The cost of the most expensive controls used in the model range from between $30,000 and $80,000 per ton. It has been suggested that these may appropriately reflect the marginal cost (on top of identified controls) to achieve emission reductions necessary to attain a more stringent standard.[3]

EPA argues that a lower cost is more appropriate, and that, due to resource limitations, an average cost per ton in the range of $2,000 to $10,000 per ton is "preferred." However, contrary to EPA's assertion, there is no justification for using *average* current control costs to estimate of the costs of bringing residual nonattainment areas into attainment. Even using the $30,000 to $80,000 per ton range provided in the RIA will understate the costs of full attainment. Control strategies with per-ton costs in this range have already been applied in EPA's model and been exhausted, leaving only more expensive controls available for further reductions in precursor emissions.

Using EPA's range in marginal per-ton costs as conservative estimates of the incremental cost of controlling these emissions, and EPA's estimates of the residual tons in nonattainment, we estimate the cost of going from partial attainment to full attainment. The incremental costs of achieving full attainment, shown in the second column of Table C-1, are significantly larger than EPA's estimates for partial attainment. The upper end of the range is more than an order of magnitude greater than EPA estimates. Combining EPA's estimate of the costs of partial attainment with our estimates of the incremental cost of going from partial to full attainment, we estimate that the cost of meeting the current standard will be between $18 billion and $65 billion per year. Meeting the proposed 8-hour 0.08 ppm standard would cost an additional $9 billion to $83 billion per year.

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[3] RIA, VI(G)

Table C-1
Costs of Full Attainment
(EPA's Costs/Ton and Residual Emissions)
(in billions of 1990 dollars)

	EPA's Cost Estimates for Partial Attainment	Additional Cost of Full Attainment	Total Incremental Cost of Full Attainment
Current	$2.3	$15.4 - $62.6	$17.7 - $65.0
Proposed Std.	$2.2 - $6.3	$6.9 - $76.8	$9.1 - $83.1

The range in estimates for the proposed standard reflects the two analyzed alternatives that bracket EPA's proposal (the 8H4AX-80 and 8H1AX-80 alternatives). The additional costs of full attainment, in the third column of Table C-1, also reflect the range of emissions presented by EPA in RIA Table VI-10, and the range in marginal cost estimates ($30,000 to $80,000).

II. Full costs adjusted for biases in EPA's methodology

EPA appears to understate the residual tons of emissions that would have to be removed to comply with the current and proposed standards.[4] As discussed in Section III and Appendix A of these comments, EPA makes two key assumptions that appear to understate the number of areas that will not attain each standard. First, EPA uses a concentration level of 0.092 ppm rather than 0.08 ppm as the standard of attainment. Second, EPA assumes that achieving 75% of the necessary pollution reductions is equivalent to achieving full compliance. (As noted above, EPA does not suggest that enforcement of the standards would be so lenient, nor does EPA make equivalent assumptions when estimating the benefit of reduced emissions.)

Appendix A of EPA's RIA presents the residual tons associated with areas classified as marginal because they can meet 115% of the standard, and areas that are within 75% of the standard. Applying EPA's marginal costs to the residual tons in these areas, as well as the areas that EPA's methodology would classify as out of attainment, we obtain a more realistic picture of the costs of full attainment. These estimates are presented in Table C-2.

[4] RIA Table VI-10

The full cost of attaining the current standard is likely to be between $22 billion and $53 billion per year. The proposed standards are estimated to impose additional costs in the range of $54 billion to $328 billion per year (1990 dollars). To put these costs in perspective, the lower end of the range is greater than the state of Oregon's entire gross state product[5] in 1990. (It was $53 billion.) The combined gross product of all six New England states was $327 million in 1990 — less than the upper bound of this range.[6]

Table C-2
Costs of Full Attainment
(EPA's Costs/Ton and Adjusted Residual Emissions[7])
(in billions 1990 dollars)

	EPA's Cost Estimates for Partial Attainment	Additional Cost of Full Attainment	Total Incremental Cost of Full Attainment
Current	$2.3	$19.2 - $51.1	$21.5 - 53.4
Proposed Std.	$2.2 - $6.3	$51.6 - $322.0	$53.8 - $328.3

III. Impact on economic growth

The cost estimates presented above, large as they are, may still understate the impact of the proposed NAAQS because they suggest that the proposed 0.08 ppm standard, is, in fact, attainable. It is not. For example, even if driving traditional vehicles were banned in the South Coast Air Quality Management District (and the whole area used only electric vehicles), the Los Angeles area would still not be in attainment with the proposed NAAQS.[8] Thus, the true

[5] Gross State Product (or GSP) is the state equivalent of GNP.
[6] Statistical Abstract of the United States. Table No. 703.
[7] The lower bound estimate assumes all residual emissions can be removed at a cost of $30,000 per ton, while the upper bound assumes elimination of residual emissions at a cost of $80,000 per ton. We calculated the residual tons in 2007 from the table in appendix A of the RIA labeled "Nonattainment Areas Under the LCS." This table reports target and actual tons per year of VOCs and NOx emission reductions under the alternative standards. We adjusted these targets to account for the bias introduced by EPA's assumptions that achieving 75% of a standard of .092 ppm would result in attainment (discussed in Section III and Appendix A). These estimates are based on EPA's LCS baseline, which we find more defensible.
[8] The South Coast Air Quality Management District "Proposed Modifications to the Draft 1997 Air Quality Management Plan" predicts average VOC emissions of 222 tons per day, or 81,000 tons per year in 2006. By 2010, emissions are expected to decrease to 60,000 tons per year. Using

costs of an unattainable standard is the opportunity cost associated with nonattainment, or a decline in the rate of economic growth.

Elsewhere, EPA has recognized that the true social cost of pollution control exceeds the direct costs of compliance.

> [D]irect costs are an imperfect proxy for the social costs of pollution control regulation. The true social costs of pollution control are represented by the total value that society places on the goods and services foregone as a result of resources being diverted to environmental protection. Compliance costs do not fully reflect social costs because they neglect direct regulatory impacts that do not involve out-of pocket costs as well as the intertemporal and secondary effects of environmental protection. In other words, they do not account for the dynamic, general equilibrium effects created throughout the economy that impose costs on industries and households not directly affected by regulation. Environmental protection imposes costs on virtually all economic entities—including the general public—that are largely hidden. Examples of social costs imposed by pollution controls that are not reflected in direct compliance cost estimates include lost or delayed production and consumption opportunities, reduced economic productivity, and higher price inflation. Some recent research suggests that compliance cost estimates may understate substantially the true long-term costs of pollution control.[9]

Predicting the effect of a regulation on economic growth, and consumption and production opportunities is very difficult to do with any degree of accuracy, and yet it is important that EPA at least recognize the opportunity cost of this proposal. We have attempted to make a rough estimate of these costs, using some assumptions about the effect of the proposal on Gross Domestic Product (GDP).

Henderson[10] observes that counties with a record of attainment with the current ozone NAAQS have 7 to 10 percent more establishments in industries that emit VOCs than counties in nonattainment. Henderson finds

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linear interpolation, one would expect about 76,000 tons per year in 2007. According to Appendix A of the RIA, Los Angeles must reduce 81,000 tons per year in 2007 to reach attainment.

[9] EPA, "Environmental Investments: The Cost of a Clean Environment," November 1990. EPA references M. Hazilla and R. Kopp, *The Social Cost of Environmental Quality Regulations: A General Equilibrium Analysis*, Discussion Paper QE89-11, Resources for the Future, Washington, DC, March 1989.

[10] "Effects of Air Quality regulation," *The American Economic Review*, Vol. 86, No. 4. (September 1996)

that these industries locate establishments in attainment areas at the expense of nonattainment areas. However, since under the proposed standard, a large fraction of the country may be out of attainment, relocation within the U.S. will be a less viable option. Instead, we might expect to see manufacturing industries locating establishments in other countries. Assuming that 20 percent of GDP is affected by these standards[11], and using Henderson's lower estimate of a 7 percent impact on the location of establishments in nonattainment areas, the impact on GDP could be about $80 billion per year.

[11] This is rough, but not unreasonable. The manufacturing sector comprises about 18 percent of GDP. A portion of wholesale and retail trade, which represent 16 and 19 percent of GDP, respectively, will also be affected.

Summary of Incremental Control Measures and Potentially Affected Source Categories for the Ozone NAAQS Review[1]

Source Category	Control Measure
Stationary Point Sources	
VOC Emissions	
Automobile and Light-Duty Truck Surface Coating (Industrial Surface Coating)	Add-on Control Levels
Plastic Parts Surface Coating (Industrial Surface Coating)	Add-on Control Levels
Flatwood Products Surface Coating (Wood Products Surface Coating)	California (CA) ozone Federal Implementation Plan (FIP) VOC limits
Wood Furniture Surface Coating (Wood Products Surface Coating)	CA FIP VOC limits
General/Unspecified Surface Coating Operations (Industrial Surface Coating)	Add-on Control Levels
General/Unspecified Surface Coating Operations (Wood Products Surface Coating)	CA FIP VOC limits
Metal Product Surface Coating	FIP VOC limits
Rule Effectiveness Improvements	Increase Compliance with Regulations
Incineration/Open Burning	Episodic Ban

[1] This table is a reproduction of EPA's Table C-1 in Appendix C of the RIA.

Source Category	Control Measure
Stationary Point Sources (cont.)	
NOx Emissions	
Utility Boilers: Oil-Gas Tangentially Fired	Selective Catalytic Reduction (SCR)
Industrial Boilers: Pulverized Coal	SCR
Industrial Boilers: Stoker (Coal)	SCR
Industrial Boilers: Residual Oil	SCR
Industrial Boilers: Distillate Oil	SCR
Industrial Boilers: Natural Gas	SCR
Cement Manufacturing: Dry Kiln	SCR
Glass Manufacturing: Container Glass	Oxy-Firing
Gas Turbines: Natural Gas	SCR + Steam Injection
Gas Turbines: Oil	SCR + Water Injection
Process Heaters: Natural Gas	Low-NOx Burners (LNB) + SCR
Process Heaters: Distillate Oil	LNB + SCR
Municipal Waste Incinerators	Selective Noncatalytic Reduction (SNCR)
Incineration/Open Burning	Episodic Ban

Source Category	Control Measure
Stationary Area Sources	
VOC Emissions	
Gasoline Service Stations: Underground Storage Tanks and Stage I - Truck Unloading	Install Pressure Vacuum (PV) Valves on Vent Line + Vapor Balance [Clean Air Act (CAA) Base Case Extended to Other Areas]
Bulk Terminals	Reasonably Available Control Technology (RACT): CAA Base Case Extended to Other Areas
Adhesives: Industrial	RACT: CAA Base Case Extended to Other Areas
Aircraft Surface Coating (Industrial)	Add-on Control Levels
Autobody Refinishing	CA Best Available Retrofit Control Technology (BARCT)
Autobody Refinishing	CA FIP Limits
Paper Surface Coating (Industrial)	Add-on Control Levels
Flatwood Product Surface Coating	Reformulation
Wood Furniture Surface Coating	Reformulation
Marine Surface Coating	Add-on Control Levels
Metal Product Surface Coating	VOC Content Limits and Improved Transfer Efficiency
Miscellaneous Surface Coating	Add-on Control Levels
Miscellaneous Surface Coating	Default Maximum Control Technology (MACT) Surface Coating Limits
Pharmaceutical Manufacturing	RACT: CAA Base Case Extended to Other Areas
Cutback Asphalt	RACT (Switch to Emulsified Asphalt): CAA Base Case Extended to Other Areas

Source Category	Control Measure
Stationary Area Sources (cont)	
Synthetic Organic Chemical Manufacturing Industry (SOCMI)	RACT: CAA Base Case Extended to Other Areas
Batch Reactor Processes	
SOCMI Fugitive Emission Leaks	New Control Techniques Guideline (CTG) Document
Petroleum Refinery Fugitive Emission Leaks	RACT: CAA Base Case Extended to Other Areas
Oil and Natural Gas Production Fields	RACT (Equipment/Maintenance): CAA Base Case Extended to Other Areas
Aerosol Paints	California Tier 2 Standards
Aerosol Paints	South Coast Air Quality Management District (SCAQMD) Potential Standards
Pesticides	Reformulate Coatings to Lower VOC Content (Based on California Ozone FIP Rule)
NOx Emissions	
Industrial Coal Combustion	RACT to Small Sources
Industrial Oil Combustion	RACT to Small Sources
Industrial Natural Gas Combustion	RACT to Small Sources
Residential Water Heaters	LNB
Residential Space Heaters	LNB
Open Burning	Episodic Ban

Source Category	Control Measure
On-Highway Motor Vehicles	
VOC and NOx Emissions	
Light-Duty Gasoline Vehicles and Trucks	California Low Emitting Vehicle (LEV) Program
Light-Duty Gasoline Vehicles and Trucks	Enhanced Inspection and Maintenance Program
Light-Duty Gasoline Vehicles and Trucks	Federal Reformulated Gasoline Program
Light-Duty Gasoline Vehicles and Trucks	California Reformulated Gasoline Program
Light-, Medium-, and Heavy-Duty Vehicles and Trucks	California Reformulated Diesel Program
Nonroad Vehicles	
VOC and NOx Emissions	
2- and 4-Stroke Nonroad Engine Categories	VOC Benefits Associated with Phase I Reformulated
Airport Service Equipment	Gasoline Program for On-Highway Vehicles
Recreational Equipment	
Industrial Equipment	
Logging Equipment (chain saws and shredders)	
Light Commercial/Utility Equipment	
(generator sets, pumps, air compressors, welders, and pressure washers)	
Construction Equipment (tampers/rammers, plate compactors, rollers,	
paving equipment, surfacing equipment, signal boards, concrete/	

Source Category	Control Measure
Nonroad Vehicles (cont.)	
VOC and NOx Emissions	
industrial saws, cement and mortar mixers, and dumpers/tenders)	
Farm Equipment (2-wheel tractors, agricultural mowers, sprayers, tillers,	
and hydro-power units)	
Lawn and Garden Equipment (lawn mowers, tillers, trimmers/edgers/brush	
cutters, leaf blowers/vacuums, snowblowers, rear engine riding	
mowers, front mowers, shredders, lawn and garden tractors, wood	
splitters, chippers/stump grinders, and commercial turf equipment)	
Æ175 Horsepower Compression Ignition (Diesel) Engines	California Phase II Exhaust Standards
Construction Equipment (scrapers, bore/drill rigs, excavators,	
cranes, off-highway trucks, rubber tired dozers, and	
off-highway tractors)	
Logging Equipment (fellers/bunchers)	
Commercial Marine Vessels	Emission fees
Recreational Vehicles	
2-stroke engine category	Potential California Standards
4-stroke engine category	Potential California Standards

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U.S. Environmental Protection Agency's Proposed Rule on National Ambient Air Quality Standards for Particulate Matter

Comments of

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March 10, 1997

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has an obligation to establish and periodically update standards for the maximum concentration of air pollutants that will protect public health and welfare. Since soot in the air creates a variety of respiratory and other problems, EPA for many years has maintained such a standard for particulate matter (PM), revised most recently in 1987, as one of its National Ambient Air Quality Standards (NAAQS). The current PM standard applies to all particles smaller than 10 microns.

EPA now believes that especially fine particles of soot, smaller than 2.5 microns, may pose sufficient health risks to warrant setting an additional standard specifically aimed at these much smaller particles, which "are so small that several thousand of them could fit on the type-written period of the end of a sentence."[1] Hence EPA's December 13, 1996 proposed PM rule (61 *Federal Register* 65638), while retaining the 1987 standards (slightly revised), would create a new NAAQS standard for fine particles: a PM 2.5 standard with a maximum annual average concentration of 15, and a daily maximum of 50, micrograms (ug) per cubic meter of the air that we breathe when outside. Accompanying the proposed rule is EPA's December 1996 draft *Regulatory Impact Analysis* (RIA), which explores its economic issues, in response to Executive Order 12866.[2]

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[1] Testimony of EPA Administrator Carol M. Browner before the U.S. Senate Committee on Environment and Public Works, February 12, 1997.

[2] Three statutes, the Regulatory Flexibility Act, the Small Business Regulatory Enforcement Fairness Act, and the Unfunded Mandates Reform Act also call for such economic analysis, although EPA questions their applicability to this rulemaking (61 FR 65669).

EPA describes its PM 2.5 proposed concentration limits (15/50) as a policy judgment, which distinguishes it from a science-driven decision. EPA acknowledges that "proponents of [more stringent and less stringent alternatives], both within the scientific community and in the public at large, can advance reasoned and potentially persuasive arguments in support of their preferred policy approaches." (61 FR 65660) Unfortunately, the case that EPA presents for its particular policy judgment is handicapped by fundamental unresolved scientific issues and by EPA's inadequate treatment of important policy questions concerning both benefits and costs. Until further scientific and policy analysis can be completed, an adequate basis will not exist for imposing so stringent an additional standard as EPA has proposed. In the absence of a stronger case, moving ahead now with this part (the 15/50 concentration limits) of the overall proposal could very well generate policy outcomes contrary to EPA's express intent. It is not at all clear that adoption of this new set of limits is a prudent way to improve overall public health and welfare.

The following sections discuss these points more fully:

I.	Unresolved scientific issues	page 2 and appendix (p. 19)
II.	Benefits concerns	page 4
III.	Cost concerns	page 11
IV.	Conclusion	page 18

I. Unresolved scientific issues

The most troublesome aspect of this rulemaking is that a new NAAQS with the degree of stringency EPA proposes has not been shown to be scientifically defensible. EPA's science advisers have been unable to reach agreement on whether the stringency of the proposed pair of limits for PM 2.5 particles is warranted by public health or any other considerations. Indeed, there is "no consensus on the level, averaging time, or form of a PM 2.5 NAAQS" among the members of the Clean Air Scientific Advisory Committee (CASAC) of EPA's Science Advisory Board, a legislatively established body of independent experts that provides advice to EPA on scientific and engineering issues.[3] The chair of this committee, Dr. George T. Wolff, reinforced this conclusion in February 5, 1997 testimony before the Clean Air Subcommittee of the U.S. Senate Committee on Environment and Public Works.

CASAC's June 1996 letter to EPA listed the specific recommendations of each of its twenty-one scientists (the CASAC list is attached as Table 1). Only two of the twenty-one scientists were willing to endorse an acceptable general range as stringent as even 15-20 ug for an annual PM 2.5 standard. Dr. Wolff's February 1997 Senate testimony confirmed this result, noting that "only a

[3] CASAC closure letter of June 13, 1996 docketed as EPA-SAB-CASAC-LYR-96-008.

TABLE I
Summary of CASAC Panel Members Recommendations
(all units μg/m³)

		$PM_{2.5}$ 24-hr	$PM_{2.5}$ Annual	PM_{10} 24-hr	PM_{10} Annual
Current NAAQS		N/A	N/A	150	50
EPA Staff Recommendation		18 - 65	12.5 - 20	150[13]	40 - 50
Name	**Discipline**				
Ayres	M.D.	yes[2]	yes[2]	150	50
Hopke	Atmos. Sci.	20 - 50[5]	20 - 30	no	40 -50[4]
Jacobson	Plant Biologist	yes[2]	yes[2]	150	50
Koutrakis	Atmos. Sci.	yes[2,5,6]	yes[2,5,6]	no	yes[4]
Larntz	Statistician	no	25-30[7]	no	yes[2]
Legge	Plant Biologist	≥ 75	no	150	40 - 50
Lippmann	Health Expert	20 - 50[5]	15 - 20	no	40 - 50
Mauderly	Toxicologist	50	20	150	50
McClellan	Toxicologist	no[8]	no[8]	150	50
Menzel	Toxicologist	no	no	150	50
Middleton	Atmos. Sci.	yes[2,3,12]	yes[2,5]	150[3,13]	50
Pierson	Atmos. Sci.	yes[2,9]	yes[2,9]	yes[4]	yes[4]
Price	Atmos. Sci./ State Official	yes[3,10]	yes[10]	no[3,4]	yes[4]
Shy	Epidemiologist	20 - 30	15 - 20	no	50
Samet[1]	Epidemiologist	yes[2,11]	no	150	yes[2]
Seigneur	Atmos. Sci.	yes[3,5]	no	150[13]	50
Speizer[1]	Epidemiologist	20 - 50	no	no	40 - 50
Stolwijk	Epidemiologist	75[7]	25-30[7]	150	50
Utell	M.D.	≥65	no	150	50
White	Atmos. Sci.	no	20	150	50
Wolff	Atmos. Sci.	≥75[3,7]	no	150[3]	50

[1] not present at meeting; recommendations based on written comments
[2] declined to select a value or range
[3] recommends a more robust 24-hr. form
[4] perfers a $PM_{10-2.5}$ standard rather than a PM_{10} standard
[5] concerned upper range is too low based on national $PM_{2.5}/PM_{10}$ ratio
[6] leans towards high end of Staff recommended range
[7] desires equivalent stringency as present PM_{10} standards
[8] if EPA decides a $PM_{2.5}$ NAAQS is required, the 24-hr. and annual standards should be 75 and 25 μg/m³, respectively with a robust form
[9] yes, but decision not based on epidemiological studies
[10] low end of EPA's proposed range is inappropriate; desires levels selected to include areas for which there is broad public and technical agreement that they have $PM_{2.5}$ pollution problems
[11] only if EPA has confidence that reducing $PM_{2.5}$ will indeed reduce the components of particles responsible for their adverse effects
[12] concerned lower end of range is oo close to background
[13] the annual standard may be sufficient; 24-hr level recommended if 24-hour standard retained

minority of the Panel members supported a range that includes the present EPA proposals." In other words, CASAC could find no scientific basis for selecting 15 ug as an annual PM 2.5 standard.

At the same time, CASAC was able to reach agreement, although with two members dissenting, that available studies do support establishing some type of new NAAQS for PM 2.5 particles. This is because CASAC did find it plausible to suspect that fine particles represent pollutants that differ from coarse particles in their source as well as size and also pose health risks, the extent and nature of which remain speculative. In other words, EPA's science advisers could agree that fine particles warrant concern, but one now too poorly understood to justify selection of a stringent standard. Dr. Wolff's Senate testimony identifies "many unanswered questions and uncertainties" that make it impossible at this time to use health effects as a basis for choosing any particular degree of stringency: these include, but are not limited to, doubts about which fine particles are hazardous and about how to interpret observed correlations between health effects and PM.[4] CASAC scientists are not confident that the proposed efforts to control PM 2.5 will yield EPA's expected improvement to public health.

The CASAC letter observed that "a scientifically defensible NAAQS for PM may require iterative steps to be taken in which new data are acquired to fill obvious and critical voids in our knowledge" and that "the deadlines did not allow adequate time to analyze . . . the available data on this very complex issue." In brief, EPA's science advisers conclude that the agency has neither adequately analyzed existing data nor obtained critical missing data. Thus if EPA proceeds to adopt a PM 2.5 standard at its preferred 15/50 stringency level, its decision must be defended on grounds other than science, since its own scientific experts have distanced themselves from such a choice.

EPA recognizes the need for an expanded research effort: "existing emissions inventories and air quality modeling to date . . . simply do not provide a sufficient analytical foundation from which to draw accurate results" and "sufficient current monitoring data for PM 2.5 exists in only a few cities." (RIA, p. 1-13) Nonetheless, EPA proposes to decide on the new standard before undertaking the additional research.

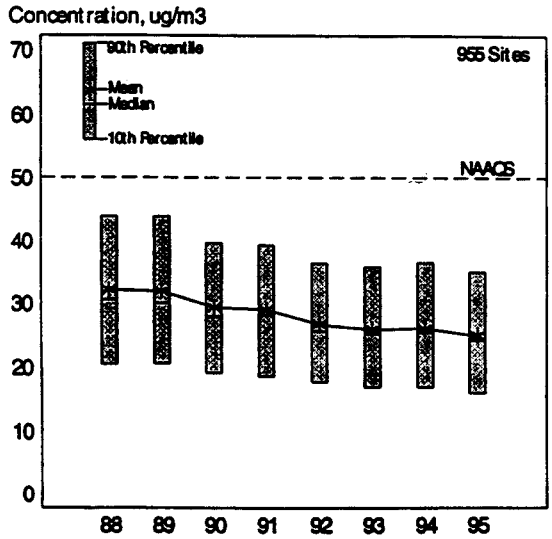
II. Benefits concerns

Adoption of EPA's December 1996 proposal would set in motion a series of regulatory actions with major consequences, marking it as one of the more significant regulations of this decade. Indeed, the magnitudes of EPA's projected health benefits and economic costs dwarf those of all but a few federal regulatory

[4] See the appendix to these comments for further detail on these unresolved scientific issues.

programs. If this rule is promulgated in its present form, a host of state and local governments will be required to develop extensive control mechanisms aimed at accelerating the pace at which ambient concentration levels of PM in their geographic areas are being reduced. That is, new State Implementation Plans containing more stringent regulatory requirements will be mandated.

It is important to recognize that PM concentration levels have been falling for a number of years and that this downward trend in PM concentrations will continue even if a new standard is not adopted. EPA's latest annual assessment of air pollution levels, issued in October 1996, shows that particulate emissions fell 79 percent from 1970 to 1995.[5] This substantial air quality improvement is all the more remarkable since it occurred during a period when pollution-generating activities were on the rise: GDP rose 99 percent and US population rose 28 percent. During the more recent period from 1988 to 1995, measured average concentration of PM-10 in the air fell 22 percent, as shown by the EPA chart reproduced below:



Trend in annual mean PM-10 concentrations, 1988-1995[6]

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[5] EPA, *National Air Quality and Emissions Trends Report, 1995* (EPA 454/R-96-005), October 1996, pp. 1, 2, 26, 27.

[6] EPA, *National Air Quality . . . Report, 1995*, Fig. 2-26, p. 27.

EPA's ongoing effort to achieve compliance with its 1987 PM NAAQS has been responsible for this substantial progress. It is true that forty-one counties across the nation, home to 29 million people, have not yet reduced their PM levels enough to meet the 1987 standard.[7] However, EPA and state/local governments in these "non-attainment" areas are making impressive headway toward achieving the 1987 standards and the corresponding air quality improvements.

Thus a basic question posed by the December 1996 proposal is whether the pace of this progress should be stepped up as well as redirected toward finer particles. Addressing this question is complicated by the fact that EPA knows of no control mechanisms that reasonably could be expected to achieve compliance with its proposed new standard. It is not clear, in other words, how substantially EPA's stringent new proposal could speed up progress. EPA states that "the suite of control measures available to be considered in the cost analysis was not sufficient to achieve full attainment in 2007." Indeed, EPA expects that some 29 million people in the year 2007 would be living in areas unable to meet its new standard. (61 FR 65668) EPA proposes to adopt this limit, which is not now attainable, in the hope that it will spur development of feasible control mechanisms. However EPA expects that compliance would not be achieved until after the year 2007 in any event.

The most important health and welfare benefits that EPA anticipates are prevention of premature fatalities and lessened illness among those with respiratory problems. As noted above, EPA thinks that only partial compliance with its proposed standard is likely by the year 2007, by which time it expects the new standard could be credited with avoiding annually some 4,000-17,000 premature deaths and 63,000 cases of chronic bronchitis. (RIA, p. 9-46) EPA uses a $4.8 million figure in monetizing the value of avoiding each of these premature deaths and a $587,500 figure as the value of avoiding each case of chronic bronchitis. (RIA, pp. 9-22 and 9-32, respectively.) A number of other health and welfare benefits also are expected and monetized, resulting in a total annual rate of benefits of $58-119 billion by the year 2007 (stated in 1990 dollars). (RIA, p. 10-3) These benefits would be larger if the new NAAQS actually were fully complied with by 2007; EPA puts the full compliance benefit total at $69-144 billion annually.

These are extraordinary claims of benefits that, if correct, might warrant according implementation of this rule high priority. One rarely encounters public policy options capable of yielding benefits this large. EPA's benefit claims, however, lack a solid foundation. The most basic concern arises from doubts about the proposal's scientific underpinnings, addressed in the preceding section of these comments (and in the appendix). It is not clear that the risk reduction achievable from implementation of this rule would avoid nearly as

[7] Table 3, EPA web site for NAAQS

many health problems as EPA anticipates. For to repeat, there is no consensus among EPA's scientific experts that the proposal can improve public health and welfare this dramatically. There is science-based evidence to suspect that fine particles may be hazardous but not to warrant their regulation at the stringency level that EPA has proposed.

Notwithstanding this fundamental reservation, suppose for purposes of exposition that the indicated number of avoided premature fatalities and illnesses would nevertheless materialize. EPA attributes most of the rule's total benefits to reduced premature fatality. EPA's calculation of the value of these benefits is driven primarily by EPA's choice of $4.8 million as the value of a statistical life. That choice results in substantially overstated benefits.

EPA's $4.8 million figure is much higher than that used by sister agencies such as the U.S. Department of Transportation, where $2.7 million was the norm for valuing a statistical life as of March 1996.[8] EPA's own Advisory Council on Clean Air Compliance Analysis concluded in October 1996 that "4.8 million (1990 U.S. dollars) significantly overstates the value most people would attach to the average number of life years saved (per person) by the Clean Air Act."[9] The National Research Council, in a 1996 study of the transportation industry that took into account all sources of air pollution (including a much broader array of hazardous pollutants than just PM), reported that "12 years are lost on average by a person who dies prematurely as a result of air pollution."[10] The American Lung Association puts the average at two years of shortened life span from exposure to particulates,[11] while other studies find an even shorter period.[12] The National Research Council also stated that "the valuation of the expected increase in deaths from increased exposure to pollution . . . is $1.3 million per death."[13] To the extent that premature fatality attributable to PM on average entails fewer than 12 years of lifetime foregone, then the appropriate statistical valuation would be correspondingly smaller than $1.3 million/death.

A considerably more informative explanation of health benefits would have emerged if EPA had used a different metric than "premature deaths avoided" and correspondingly adjusted downward its valuation. If public policy alternative A could prolong an average life by six months while alternative B prolonged it by fifteen years, it is hard to imagine anyone who would contend such information is irrelevant to the choice of policy; EPA's proposal and RIA recognize no such distinction. EPA's Advisory Council had recommended that "premature mortality . . . be stated in terms of the expected number of life years

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[8] The Office of the Secretary of the Department of Transportation updates this figure annually.
[9] Council letter to EPA dated October 23, 1996, docketed as EPA-SAB-Council-ltr-97-001.
[10] National Research Council, *Paying Our Way: Estimating Marginal Social Costs of Freight Transportation*, TRB Special Report 246 (Washington, DC: National Academy Press, 1996), p. 159.
[11] As cited in Bob Herbert's "Bad Air Day," *The New York Times*, February 10, 1997, p. A15.
[12] Robert W. Crandall et al, "Clearing the Air," *Regulation*, 1996, No. 4, p. 44.
[13] National Research Council, op.cit.

saved, and that life years be valued instead of statistical lives." This also was the recommendation last year of a panel of eleven experts on regulatory analysis that includes, among others, Nobel-laureate Kenneth J. Arrow:

> "a program that extends a life by thirty years should be valued more highly than one that extends it for three. Where policies are expected to extend a life, it is better to estimate the number of life-years extended than solely the number of lives."[14]

EPA's response is little more than an acknowledgment that "more research is needed in this area." (61 FR 65643) Its RIA indicates some sensitivity analysis has been undertaken, for example assigning a value of $3.6 million per statistical life rather than $4.8 million. However, no further results are reported in either the *Federal Register* notice or the RIA. (RIA, p. 9-45) Thus EPA's benefits portrayal rests on (a) a substantial overestimate of the monetary valuation of (b) an estimate of premature deaths avoided that itself lacks scientific credibility.

Furthermore, EPA does not consider either comparative risks or potential secondary health effects of the standard. The 1997 final report of the Presidential/Congressional Commission on Risk Assessment and Risk Management (Presidential Commission) points out that "many risk management failures can be traced to . . . not considering risks in their broader context" and that traditionally "most risk management has occurred in an artificially narrow context" without regard for other risks.[15] As one example, EPA's proposal is silent on the possible significance of an unwelcome side-effect that the agency identified in its companion notice about implementation: "a reduction of a fine particle precursor possibly can increase ozone or increase a different fine particle component (e.g., SOx reductions leading to increased ammonium nitrate, or NOx reductions increasing sulfate formation)."[16] The Presidential Commission emphasizes that "tradeoffs among different risks must be identified and considered." Yet whether certain fine particles are more important to control than others is not considered in EPA's proposal, so if such tradeoffs occur it will not be possible to judge whether overall health risks are rising or falling. The Presidential Commission concludes that "analysis must consider whether an option may cause any adverse consequences,"[17] but EPA appears not to have done so.

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[14] Kenneth J. Arrow et al., *Benefit-Cost Analysis in Environmental, Health, and Safety Regulation--A Statement of Principles* (Washington, DC: American Enterprise Institute, 1996), p. 13.

[15] The Presidential/Congressional Commission on Risk Assessment and Risk Management, *Framework for Environmental Health Risk Management, Final Report*, Vol. I, January 1997, pp. 5, 9.

[16] EPA, "Advance Notice of Proposed Rulemaking: Implementation of New or Revised Ozone and Particulate Matter Air Quality Standards and Regional Haze Program," Section II(B)(2), *Federal Register*, December 13, 1996

[17] Presidential Commission, p. 35.

More risk comparisons are recommended by the Presidential Commission, both with other risks that a particular agency regulates and with other risks facing the public, including "risks posed by water contamination and solid wastes . . . and other risks to public health." This would increase the odds that opportunities for substantial gains in health and environmental quality could be targeted more effectively. Specifically with respect to "the increasing incidence and mortality rates of asthma," it points out that "reasons for the increases are not known, but likely candidates include sulfur oxides, smog, particles, and second-hand smoke."[18] When relative risks are not clearly portrayed, regulatory agendas are not likely to be as protective of public health or the environment as they could be. Neither the *Federal Register* notice nor the RIA provides much information of this type, noting that "although the increase in relative risk is small for the most serious outcomes, it is likely significant from an overall public health perspective, because of the large number of individuals in sensitive subpopulations that are exposed to ambient PM and the significance of the health effects." (61 FR 65653-4) No comparative risk data are given, so this sheds little light on how serious EPA thinks the PM health risk may be relative to others.

From a public health perspective, such a deficiency is serious; one recent study conducted at the Harvard Center for Risk Analysis found that a reallocation of current spending from lower risk to higher risk problems could more than double the life-saving results.[19] Such gains are likely even when various bureaucratic constraints are left untouched, such as blocking any shifting across agencies or types of protective actions ranging from injury reduction and medicine to toxin control. That is, if each agency kept imposing the same total regulatory cost but merely targeted its efforts more efficiently, life years saved nearly doubled in the cases the Harvard study examined. Greater attention to such risk comparisons could result in valuable gains to the environment and public health, but EPA's PM proposal largely ignores this important public health concern.

To clarify the point about risk comparisons, consider EPA's August 1996 final rule on lead-based paint inspections in houses. (61 FR 45778) This document puts the future health benefits of household lead paint abatement in the range of $2-54 billion, when discounted to present values. Any acceleration of lead abatement activities (that EPA now expects will accrue over the next fifty years) would sharply increase these present values. That particular lead rule itself, however, does not yield measurable benefits, since it merely mandates inspector training requirements that "provide a vehicle that will aid in the realization of these benefits." (61 FR 45808-45809) Both the PM documents and

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[18] Presidential Commission, p. 11.

[19] Tammy O. Tengs and John D. Graham, "The Opportunity Cost of Haphazard Social Investments in Life-Saving," in R. Hahn (editor), *Risks, Costs, and Lives Saved: Getting Better Results from Regulation* (New York: Oxford University Press, 1996).

the lead rule documentation show no concern nor interest in the relative contribution to improved public health that accelerated progress could achieve in these two important environmental areas.

Were unlimited funds available to pay for regulatory compliance, the absence of such relative risk considerations would be more understandable, although still troublesome (unless all problems could be tackled simultaneously). Since consumers and state-local governments already are spending the equivalent of nearly ten percent of GDP annually to comply with existing federal regulations, any notion that "unlimited funds" are available for new regulatory initiatives would seem suspect at best.[20]

Moreover, any policy initiative motivated by concerns about health and welfare is seriously myopic if it ignores unavoidable linkages between regulatory costs and family health. A mounting body of research indicates that serious health problems arise when a family's living standards decline. Whenever government actions reduce real family income levels, noted Supreme Court Justice Stephen Breyer, "that deprivation of real income itself has adverse health effects, in the form of poorer diet, more heart attacks, ..."[21] Costly government regulations adversely affect productivity, which in turn dampens real income.[22] The Presidential Commission offers an analogy that makes this point less abstractly:

> "If a new policy is instituted that limits the application of a widely used pesticide, the cost of certain fruits and vegetables could increase significantly. Should this occur, those who still can afford to buy those fruits and vegetables may benefit by enjoying reduced health risks from pesticides. However, economists argue, others who can no longer afford those fruits and vegetables may suffer poorer nutrition and increased cancer risk associated with eating too few fruits and vegetables."[23]

Harvard University's W. Kip Viscusi indeed has calculated that "every $50 million spent on regulation induces one statistical death due to the income-mortality connection."[24] EPA puts the annual cost of partially attaining its proposed new standard at $6.3 billion, a figure discussed further in the next

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[20] Thomas D. Hopkins, *Regulatory Costs in Profile*, Center for the Study of American Business, Washington University in St. Louis, August 1996.

[21] Stephen Breyer, *Breaking the Vicious Circle--Toward Effective Risk Regulation* (Cambridge, Mass: Harvard University Press, 1993), p. 23.

[22] See, for example, estimates of the adverse effect on GDP attributable to the 1990 Clean Air Act amendments in Dale Jorgenson and Peter J. Wilcoxen, "Impact of Environmental Legislation on U.S. Economic Growth, Investment, and Capital Costs," in *U.S. Environmental Policy and Economic Growth: How Do We Fare?* (Washington, DC: American Council for Capital Formation, 1992).

[23] Presidential Commission, p. 33.

[24] W. Kip Viscusi, "The Dangers of Unbounded Commitments to Regulate Risk," in Hahn, p. 162.

section. If EPA's cost figure were correct, Viscusi's findings would imply that the diversion of spending to comply with the new rule would itself cause over 100 premature fatalities annually.

EPA's RIA ignores this type of adverse health effect attributable to regulatory compliance costs, thereby further overstating the health benefits the rule might produce. It is an example of what the Presidential Commission counsels against: "Considering a risk in isolation cannot provide decision-makers or the public with any sense of how important the risk is, compared with other risks, or of the impact that reducing or eliminating it might have on overall human and ecosystem health."[25]

III. Cost issues

EPA believes that its NAAQS decision cannot take economic effects into account, and thus its RIA economic analysis results "have not been considered in developing this proposal." (61 FR 65668) In part, this is a matter of statutory wording and court decisions that EPA contends direct it to set NAAQS levels without regard to economics. "Judicial decisions make clear that the economic and technological feasibility of attaining ambient standards are not to be considered in setting them." (61 FR 65667) EPA emphasizes that its proposal rests on a policy judgment driven entirely by the objective of protecting public health and welfare. It notes explicitly that such protection does not entail zero-risk, recognizing that some degree of risk from exposure to PM is unavoidable. "The Act does not require the Administrator to establish a primary NAAQS at a zero-risk level, but rather at a level that reduces risk sufficiently so as to protect public health with an adequate margin of safety." (61 FR 65639)

EPA also takes the position that this rulemaking in itself imposes no costs, since it merely sets allowable concentration ceilings. Costs would ensue, but only as later implementation regulations are complied with.

> "Regulations implementing the NAAQS might establish requirements applicable to small entities, but the NAAQS itself would not. . . . The Administrator certifies that this proposed rule will not have a significant economic impact on a substantial number of small entities." (61 FR 65669)

As a practical matter, costly new implementation regulations would be unavoidable if this rulemaking adopts EPA's proposed new NAAQS limits. To defer consideration of costs until later decision points, as EPA would prefer, is tantamount to signing a purchase contract before knowing its bottom line. The fact that signing such a contract leads only later to a stream of bills is not

[25] Presidential Commission, p. 38.

normally interpreted as being a costless event. Neither is it prudent to wait until the bills appear before considering their impact.

The RIA estimates that in nearly half of all U.S. industries there will be at least one establishment that faces compliance costs, and that in half of these cases compliance costs will exceed 3 percent of sales revenues; EPA takes this to mean that these firms "may experience potentially significant impacts." (RIA, p. ES-15) To place such costs in context, the average U.S. firm now spends about 2.7 percent of its sales revenues to comply with all existing federal regulation (including paperwork requirements).[26] The RIA estimates thus imply that a sizable number of firms will find their overall regulatory compliance spending being doubled just to meet the change in the PM standard, plus whatever compliance costs will flow from other new regulations such as the pending ozone rules.

Costs would not be spread evenly across industries or the country, of course, and counties with "non-attainment" designations will face greater regulatory enforcement attention than elsewhere. State Implementation Plans would have to target non-attainment areas with new mandates.

> "If a county is not in attainment for a particular pollutant, . . . new manufacturing firms to the county will be subject to more stringent regulations governing equipment specifications. Existing firms in nonattainment areas face stricter requirements to reduce source emissions."[27]

Such unevenness has some unwanted side-effects: "there will be a tendency for polluting industries (which are subject to greater scrutiny) to move from nonattainment areas (dirtier, more regulated) counties to attainment (cleaner, less regulated) counties."[28] To the extent that this occurs, pollution will be redistributed across the country but not reduced. In addition, whatever concern may exist about firms moving offshore to avoid regulatory burdens might be exacerbated, adding another dimension to the cost picture.

EPA traditionally has tried to deal with this problem "by setting stringent standards and compromising on compliance schedules."[29] This of course serves to defer and limit both benefits and costs of the standard. The regulatory strategy that EPA is pursuing, even were it to deliver important public health benefits at some future date, has these "perverse economic consequences . . .

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[26] Hopkins, p. 12.
[27] J. Vernon Henderson, "Effects of Air Quality Regulation," *The American Economic Review*, Vol. 86, No. 4, September 1996, p. 790.
[28] Henderson, p. 792.
[29] R. Shep Melnick, "The Politics of Benefit-Cost Analysis," in P. B. Hammond and R. Coppock (editors), *Valuing Health Risks, Costs, and Benefits for Environmental Decision Making* (Washington, DC: National Academy Press, 1990), p. 47.

[and] also breeds cynicism, which makes all regulatory activity more difficult."[30] To establish a standard so stringent that EPA admits its attainment seems from the outset not feasible even ten years into the future hardly can be expected to build citizen confidence in the reasonableness of government action. It certainly is difficult to reconcile this strategy with EPA's stated intent of "establishing adequately protective, effective, and efficient" standards. (61 FR 65654)

Under the Clean Air Act, EPA must select, in addition to the primary standard discussed to this point, a companion secondary NAAQS, whose aim is to protect the public welfare (as distinct from health) from "any known or anticipated adverse effects" after taking into account, among other things "effects on economic values." When discussing the welfare issue of visibility, the *Federal Register* language suggests that setting a standard low enough to ensure good visibility nationwide would require closing vast numbers of manufacturing plants and sharply curtailing other sources such as autos and home furnaces. Stated more technically,

> "national secondary standards intended to maintain or improve visibility conditions on the Colorado Plateau [i.e., much of the western US] would have to be set at or even below natural background levels in the East, the attainment of which would effectively require elimination of all eastern anthropogenic emissions [e.g., factories, autos, home furnaces]." (61 FR 65664)

Thus, EPA declines to propose a standard that would protect visibility fully, determining that a secondary standard for PM 2.5 should be set at, and not lower than, the 15/50 pair of limits being proposed as the primary standards. Any more stringent secondary standard would be prohibitively costly, adversely affecting economic values.

Tradeoffs, in other words, cannot be avoided in thinking about the secondary standard, since one form of public welfare, improved visibility, "an important welfare effect because it has direct significance to people's enjoyment of daily activities," unavoidably comes at a cost in terms of other forms of public welfare foregone, such as economic activity and material prosperity. (61 FR 65662) The public welfare benefits of visibility would be larger if visibility everywhere were protected, and such a result would be meritorious if it could be achieved more fully without compliance difficulties. Thus EPA apparently takes costs into account in setting the secondary standard, notwithstanding its assertion elsewhere (noted above) that the RIA and economics were not taken into account in formulating the proposed changes to the PM NAAQS.

EPA's effort to de-couple cost questions from standard setting is not surprising, given the language of the Clean Air Act. Yet, as discussed above, this

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[30] Melnick, op.cit.

does a disservice to public health protection, in light of the potential damage to public health that results from the compliance costs themselves. Moreover, "the economic costs of regulation are an inescapable reality, and it is bad policy to pretend, as the present Clean Air Act does, that these costs can be ignored."[31] EPA's attempt to address this reality by contending that cost and feasibility will be reckoned with solely in the implementation phase is not very satisfactory both because costs do affect health benefits and because the designation of many areas as newly "nonattainment" imposes costs regardless of implementation plans and schedules.

Notwithstanding EPA's reservations about the relevance of cost analysis to this regulatory decision, its RIA does present a picture of costs that may emerge during one year a decade from now. A total of $6.3 billion would be spent that year for moving part of the country from compliance with the 1987 standard to partial compliance with the new PM 2.5 standard. (RIA p. 7-8) This $6.3 billion is in addition to a $1.6 billion per year increase in spending needed just to finish the job of achieving compliance with the 1987 standard. (RIA, p. 7-10) The RIA characterizes these as "direct control costs," as distinct from true social costs, and states that "social costs are typically somewhat smaller than direct control costs" after markets have adjusted to price and output changes. (RIA, p. 10-4) This is a surprising assertion, one that is contrary to mainline economic research findings and that is not supported in the RIA. The 1995 *Journal of Economic Literature*'s statement is more likely to be accurate:

> "The overall social costs of environmental regulation will exceed direct compliance costs because regulations can cause reductions in output, inhibit investments in productive capital, reduce productivity, and bring about transitional costs."[32]

Two particular aspects of EPA's single-year cost picture deserve some attention--what costs are included, and their time pattern relative to benefits. For a benefit-cost analysis to have any value, benefits and costs must be estimated symmetrically, using the same assumptions about degree of compliance and geographic areas affected, for example. The RIA suggests that the analysis excludes counties that do not now have monitoring in place, thereby excluding 40 percent of the nation's population, and that only partial compliance is anticipated even among those counties. (RIA, p. 1-16) It would seem plausible to expect that more counties will have monitors in 2007 than now exist and that costs surely would be faced by businesses in such additional counties if they are to comply with the NAAQS; EPA thinks not, contending that "significant increases in the number of monitoring sites in the future is not expected." (RIA, p. ES-11) By contrast with EPA's view, CASAC chair Dr. George T. Wolff states:

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[31] Alan J. Krupnick & J. W. Anderson, "Revising the Ozone Standard," *Resources*, Fall 1996, p. 8.

[32] Adam B. Jaffe et al., "Environmental Regulation & the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Literature*, Vol. 33, March 1995, p. 153

> "It is likely that there will be significant numbers of counties currently without monitors that will eventually be found to be out of attainment. As a consequence, the actual number of PM nonattainment areas will be substantially higher than EPA's estimates."[33]

In that event, EPA's partial compliance estimates, which anticipate substantial noncompliance in now monitored counties and no costs in counties not now monitored, understate national costs that will be incurred.

And as to symmetry, it is not clear whether the benefits analysis and cost analysis are fully comparable. Benefits are attributed to both unmonitored and monitored counties, due to transported soot, while costs seem to be assumed arising only in monitored counties. (RIA, p. ES-11) "The benefit analysis considers risk reductions nationwide, rather than for specific locations within the United States." (RIA, p. 9-3) Yet the RIA "estimates the control costs for achieving the PM alternatives in counties currently monitored for PM 10." (RIA, p. 7-2)

EPA provides no details about the size of annual costs likely to be incurred between now and the year 2007, or thereafter, to say nothing of how this temporal pattern compares to that of the health and welfare benefits. This "snapshot" approach of the hypothetical situation a decade away is not nearly as instructive as the generally recommended approach of depicting the anticipated pattern of effects over time, along with their present values. EPA's own guidelines to its staff on the preparation of RIAs incorporated that instruction as early as 1983: "The net benefits of each major alternative may be estimated by subtracting the present value of monetary social costs . . . from the present value of monetary social benefits."[34] Yet in this rulemaking, present values of the future expected stream of benefits and costs are not shown. This is important because typically benefits lag costs, and alternative regulatory strategies have differing lags. "Both economic efficiency and intergenerational equity require that benefits and costs experienced in future years be given less weight in decision-making than those experienced today."[35] An RIA should clarify how such alternatives compare, and present value calculation is generally recommended. It is adopted by EPA in other rulemakings such as its August 1996 lead rule discussed above. (61 FR 45808)

The RIA does offer a comparison of three possible levels of stringency, using its year 2007 "snap-shot" approach, and the results warrant attention

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[33] Wolff, U.S. Senate testimony, February 1997

[34] EPA's Office of Policy, Planning and Evaluation, "Guidelines for Performing Regulatory Impact Analysis," December 1983 and reprinted March 1991.

[35] Kenneth J. Arrow et al., "Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?" *Science*, Vol. 272, 12 April 1996, p. 22.

despite the time pattern problem just discussed. In most environmental quality contexts, incremental regulatory benefits fall and incremental regulatory costs rise as more stringent standards are considered. Efficient regulatory stringency then occurs when net benefits are largest, which takes place when any further tightening of the standard would impose larger extra costs than it would yield in extra benefits. If such a crossing point never occurs, net benefits will be largest when the standard is set at zero risk, with no allowable exposure to the substance.

The RIA presents the counter-intuitive result that the most stringent alternative considered has the greatest net benefit. If this result were correct, it would mean that the agency neglected to consider a sufficiently stringent standard. The analysis, in other words, implies that selecting a tighter PM 2.5 concentration level than any of the three examined would yield health and welfare benefits that more than justify whatever compliance costs would be entailed. Either there is a deficiency in the economic analysis or the agency is missing an opportunity to deliver public health benefits efficiently. Ordinarily, so long as each more stringent alternative can be shown to generate positive incremental net benefits, the analyst would explore yet more stringent options. Surely at some point above a zero-level standard, compliance costs would start to markedly exceed any achievable benefits; if not, then a ban or zero standard would be justifiable. If EPA believed its own estimates of benefits and costs, and wanted to adopt an efficient standard, it would examine and show the results of setting a standard below the level of 12.5/50, the most stringent alternative it considered.

EPA has addressed this concern in some respects, explaining that the normal pattern of rising incremental costs and falling incremental benefits indeed does exist for PM control but is masked in the RIA by the manner in which the calculations were performed. To illustrate the former, EPA shows that in Philadelphia, going to a more stringent standard "would result in only a 1 percent additional reduction [in PM 2.5] while roughly doubling control costs." EPA decided not to consider options that might "achieve minimal air quality improvements at an unreasonable high cost" or "are unrealistically cost-ineffective." It did so by arbitrarily setting a cost ceiling, considering only air quality improvements that could be achieved through control mechanisms that cost no more than $1 billion per ug/m3 reduction. (RIA, p. 7-6)

This also explains why EPA anticipates only partial compliance with its proposed new standard. In much of the country, moving any more fully to attainment would require use of control mechanisms, given current technology, that cost substantially more than the $1 billion cutoff. EPA estimates that full attainment would require removal of an additional 13 ug/m3 PM nationally at annual costs in excess of $1 billion per ug removed. (RIA p. 7-13) While the RIA is silent on just how far above $1 billion/ug that total extra cost would go, one EPA contractor, using data for Philadelphia, found that costs would rise to $4.28

billion/ug well before attaining as much reduction as is proposed.[36] Fuller information is required to generate adequate estimates, and EPA should undertake such analysis, but this suggests that full compliance would entail additional costs of at least ($4.28 billion) x (13 ug removed) = $55 billion annually. That is, EPA's $6.3 billion cost estimate for partial compliance with its proposed new standard represents only a modest downpayment.

In part, the weaknesses of EPA's RIA that have been noted above, on both its benefit and cost calculations, may be attributable to inadequate peer review--that is, independent evaluation by experts not part of government. Such review takes place for most of EPA's scientific and technical reports, utilizing independent groups such as CASAC, and is completed before the agency publishes a proposed rule. RIAs, by contrast, receive no review by non-governmental, independent experts prior to the agency's public announcement of its proposed decision. The Office of Information and Regulatory affairs has had responsibility for RIA reviews during the past 17 years, but the Presidential Commission appears to conclude that OIRA review should be augmented: "Peer review should play a critical role in evaluation of the quality of economic analyses and the technical information underlying them."[37] That further attention to this concern may be warranted also is suggested by a recent General Accounting Office report entitled "Peer Review: EPA's Implementation Remains Uneven."[38]

Finally, turning to a broader policy concern, this proposal continues a regulatory tradition that is ripe for the type of reconsideration that led to passage of the Small Business Regulatory Enforcement Fairness Act as well as the Unfunded Mandates Reform Act. The rule's $6.3 billion annual cost as projected by EPA (for partial compliance) is essentially a budgetary and resource allocation decision, but one that is shielded from the usual budgetary process. Since these costs are paid mainly out of the budgets of consumers and state-local taxpayers, rather being accounted for in the federal budget, the decision to impose them is free of concerns about overrunning the federal government's budget or competing with other federal spending priorities.

The RIA points out that EPA could not do better than form a "snapshot" of the rule's likely benefits and costs during the single year 2007 since "multi-year air quality modeling was not feasible because of resource constraints." (RIA, p. 1-14) That is, EPA could not get enough budgeted funds to do the needed research, yet in imposing by its own estimate $6.3 billion of mandated costs on the private sector and state-local governments (for partial compliance) it faces no such "resource constraints." (In fact, the imposed costs are larger, since the RIA did not include any estimate for administrative costs that state governments will

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[36] Pechan & Associates, November 22, 1996, letter to EPA in EPA Docket A-95-54

[37] Presidential Commission, p. 36.

[38] U.S. General Accounting Office, GAO/RCED-96-236, September 1996.

bear. RIA, p. ES-23) If this rule is adopted, then the Clean Air Act would require, notwithstanding implementation flexibility and attainment deadline extensions, "that states eventually achieve the standards." (RIA, p. ES-5) Therefore, the only logical time at which to question those costs is now.

IV. Conclusion

EPA's December 1996 proposal does not offer a solid case for adopting a stringent new PM 2.5 standard. The agency's principal science advisers do not endorse it on public health grounds. The agency's RIA purporting to show overwhelmingly large net benefits has major shortcomings and serves to confuse rather than clarify important issues and values at stake. There is legitimate cause for concern about fine particles, but there do not yet exist grounds for mandating the design of a new set of implementation controls aimed at achieving any one concentration limit. Further research is needed to obtain clearer answers to the questions that have been raised. While that research is pursued, the nation's soot pollution problem will continue to decline, and thus public health protection will continue to increase, because of plans already in place to seek compliance with the 1987 PM standard. Indeed, the RIA estimates that $1.6 billion more annually will be expended just to achieve compliance with that 1987 standard (RIA, p. 7-10), which will bring greater health protection to the 29 million people still living in nonattainment areas. EPA has not established that increasing the stringency of the PM NAAQS now would be prudent, effective or efficient public policy.

Appendix: examples of unresolved scientific issues

It is not clear whether EPA has drawn correct inferences from reported statistical correlations between health effects and particulates; the following four issues are among those that require further study:[39]

• **Doubts about effects of confounding variables**

Part of the adverse health effects that EPA attributes to particulates may actually be due to other influences the studies overlooked or assessed inadequately. EPA relies on two types of studies, those tracking acute effects from temporary exposures, and those tracking chronic effects in groups of people (cohorts) monitored over longer periods. Cohort studies suggest higher fatality rates than do studies of acute effects. As the CASAC Chair reported in February:

> "the cohort studies suggest that the acute mortality only accounts for about a third to a half of the total deaths attributed to PM. However, all or most of this discrepancy vanishes when additional potentially confounding variables are included in the cohort studies and historical or cumulative rather than concurrent air pollution exposures are considered."

For example, two prominent studies of the same PM-mortality data from Birmingham, Alabama, reach opposite conclusions about whether PM 10 particles have a statistically significant effect on mortality. The earlier study (Schwartz, 1993) found such an effect; the later study (Davis, 1996) found no such effect. The only difference between the two studies appears to be that the 1996 study **did**, while the 1993 study did **not**, take into account the possible confounding influence of humidity. The 1996 study suggests that weather rather than particulates may explain the observed health effects. "When all the model uncertainties are taken into account, our overall conclusion is that we do not find any consistent effect due to PM 10."[40] Yet EPA, citing the 1993 study among others--but notably making no reference to the conflicting 1996 Davis study just quoted--thinks it "highly unlikely that weather" can be a seriously confounding variable. (61 FR 65645) EPA's conclusion seems to presume that the 1996 Davis study, which EPA partially funded, is not credible, but EPA's *Federal Register* notice provides no explanation to support that presumption.

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[39] In his February 1997 testimony before the U.S. Senate Committee on Environment and Public Works, Dr. George T. Wolff, chair of EPA's Clean Air Scientific Advisory Committee, outlined eight broad categories of scientific issues that EPA should address further before adopting its proposed PM 2.5 standard. Dr. Wolff also emphasized that the eight are only a partial listing. This appendix provides examples drawn from Dr. Wolff's Senate testimony and from other scientists to illustrate the range of important scientific issues that require resolution.

[40] Jerry M. Davis et al., "Airborne Particulate Matter and Daily Mortality in Birmingham, Alabama," Technical Report #55, November 1996, National Institute of Statistical Sciences, Research Triangle Park, NC, p. 3

• **Doubts about which types of particulates pose health problems**

It is not known what sources of particulates are most worth controlling. The CASAC Chair points out that:

> "PM 10 and PM 2.5 . . . are composed of four or five major constituents and hundreds of trace constituents . . . . The causative agent could be some constituent of the PM rather than the total PM or total PM 2.5 which would require a control strategy targeted at the causative constituent rather than at PM 10 or PM 2.5 in general."

It makes sense to place controls on those that are harmful, but a "shot-gun approach" that considers all equally risky may not constitute prudent targeting.

• **Doubts about toxicological mechanisms**

No generally accepted medical explanation exists of how current PM concentration levels could harm health. In the CASAC Chair's words: "There is no biologically plausible mechanism that could explain the apparent relationship between acute mortality and PM at concentrations that are a fraction of the present PM 10 NAAQS." Some studies question the significance of reported correlations between PM and respiratory-related deaths, and in any event correlation and causation are quite different concepts. The strength of the causal connection between health effects and particulates remains in doubt. (The EPA Particulates OAQPS Staff Paper, July 1996 raises some of these same concerns.)

• **Doubts about the shape of the dose-response function**

If no health hazard exists when PM concentration is below some particular level, that level would constitute a safe threshold. EPA assumes there is no such safe threshold, and therefore uses a "linear, no-threshold model" that attributes life-saving benefits to each further reduction in PM, no matter how clean the air already may be. Research to date has not revealed whether a safe threshold exists. Indeed, the CASAC Chair states that "present statistical methodologies are incapable of detecting the existence of a possible threshold concentration below which acute mortality would not occur."

If further research shows that such a threshold in fact exists, then EPA would have overstated how many lives its proposed rule could save. On the other hand, if EPA is correct that no threshold exists, there would be health benefits from reducing concentration levels to zero, and EPA's life-saving estimates would be more plausible. This, however, would raise a different question: to the extent that EPA disregards cost and feasibility, why would the agency elect to forego these public health improvements in proposing to set NAAQS levels above zero?

CLEAN AIR ACT: OZONE AND PARTICULATE MATTER STANDARDS

TUESDAY, APRIL 29, 1997

U.S. SENATE,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS,
PRIVATE PROPERTY AND NUCLEAR SAFETY,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
Washington, DC.

IMPACT ON STATE AND LOCAL GOVERNMENTS

The subcommittee met, pursuant to recess, at 2 p.m. in room 406, Senate Dirksen Building, Hon. James Inhofe (chairman of the subcommittee) presiding.

Present: Senators Inhofe and Sessions.

Also present: Senator Baucus.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. The subcommittee will come to order.

I assure you there will be more Members coming in from time to time and staff. There are a couple of meetings that are still taking place and they're there.

Today's hearing will be the fifth we've had. We've had four in this subcommittee and one in the whole committee concerning the proposed EPA changes in the national ambient air quality standards for ozone and particulate matter.

Throughout the entire process, we've heard allegations through the media, other congressional hearings, and the testimony from witnesses before this subcommittee that the Administration has systematically misrepresented the facts behind their proposal.

The EPA has suppressed dissenting views within the Administration. They've placed themselves above the law in regards to Small Business Regulatory Enforcement Fairness Act and unfunded mandates.

Certainly we have here in this room on the three panels a lot of people who are concerned about unfunded mandates. As a former mayor, I can assure you I understand your concern.

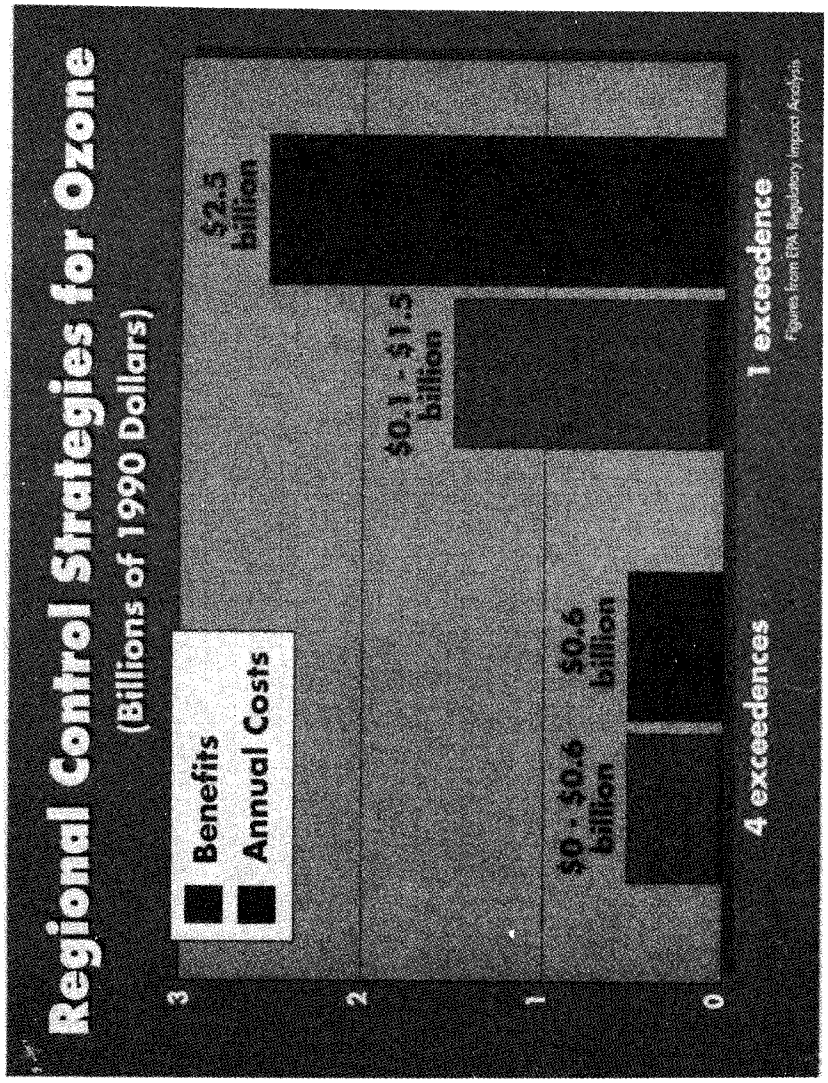
I have conducted these hearings as a forum to discover the truth and to bring to light all of the information behind the proposals. I've not focused on the abuses of the Administration because the underlying science, risk, and impacts of the proposals are the most important issues, and I've tried to avoid being sidetracked.

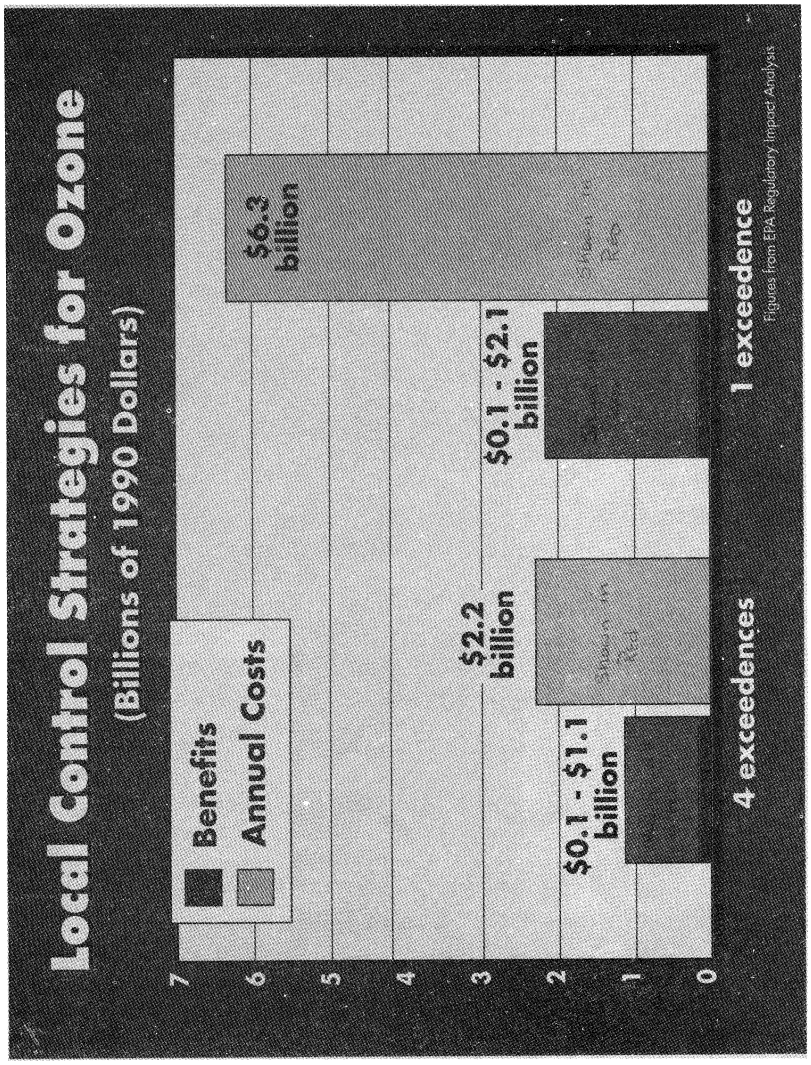
However, at last Thursday's hearing I asked Mary Nichols, the assistant administrator for Air at the EPA, a very simple and di-

rect question, whether the EPA's regulatory impact analysis shows that the cost of the ozone proposal outweighs the benefits, and she said no. This is incorrect.

We don't have large charts, but we certainly—we've passed these out. I think most people have these. This is what they came up with after they talked about the new standards. And the red line, of course, is the cost line, and the green being the benefits.

[The referenced charts follow:]


Regional Control Strategies for Ozone
(Billions of 1990 Dollars)
Benefits
Annual Costs
3
2
1
0
$0 - $0.6 billion
$0.6 billion
$0.1 - $1.5 billion
$2.5 billion
4 exceedences
1 exceedence
Figures from EPA Regulatory Impact Analysis


Local Control Strategies for Ozone
(Billions of 1990 Dollars)
Benefits
Annual Costs
7
6
5
4
3
2
1
0
$6.3 billion
$0.1 - $2.1 billion
$2.2 billion
$0.1 - $1.1 billion
4 exceedences
1 exceedence
Figures from EPA Regulatory Impact Analysis

Senator INHOFE. The EPA's regulatory impact analysis for ozone clearly shows that the costs outweigh the benefits. The cost of local control strategies outweighs the benefits anywhere from $1.1 billion to $6.2 billion. That's the range that we're looking at here, depending upon the exceedances allowed.

The cost for regional control strategies, which may not be feasible under the current law, outweigh the benefits anywhere from 0 to 2.4. This is the chart that shows that range.

These figures come straight from the EPA's document, and the costs are only for partial attainment. Under their cost estimates, the country does not even attain the proposed standards. Elsewhere in the documents they acknowledge a number of costs that they don't even calculate, and they make a number of assumptions, such as, first, they assume in the baseline full implementation of the current law, without counting these costs but counting the benefits.

In other words, those of you who have had to work hard, such as we have in our county of Tulsa, those costs that we have incurred to come up to the old standards are not included in the total cost, but the benefits are.

Second, they assume a regional NAAQS strategy for the country which includes an emissions cap for utilities without including those costs. I think we know, in fact, the first—before even having the first hearing, as chairman of this committee, when I heard about the proposed changes I went around to 21 counties in Oklahoma, and it was then that we found out what the costs were, increased cost of utilities. These increase costs are not considered even in these charts here.

Third, they assume a national low emissions vehicle without counting the cost for such a program. I think those of you from California know what we're talking about there because you've already had that mandate.

And, fourth, in a number of areas they stopped calculating the cost at 75 percent attainment. I mean, areas that are really bad, they assume that once you get the 75 percent there's no further cost.

Even without adding up these hidden costs, the EPA's documents still show the costs outweigh the benefits; yet, an assistant administrator from the EPA sat in this room last week and told me and the witnesses the exact opposite on the record. They are trying to mislead the committee and they are misleading the American people.

In addition, since these figures were published, the Agency has gone back and readjusted the benefits, decreasing all of the end points by 25 percent. So while the original costs outweighed the benefits, the current numbers outweigh the benefits even more than they were before.

As a final insult to the process, the President's own Council on Economic Advisors has estimated the cost for ozone proposal at $60 billion, 10 times greater than the EPA's cost estimate of $6 billion. It's time for the EPA to level with the public.

Public policy decisions should be conducted in an open and unbiased manner. The EPA has hidden behind the court order and data that is not available to the public. In addition, they have hidden

the real costs and dissenting viewpoints of other Government agencies.

Hopefully today we can turn to the important issues regarding the impact of these proposals.

We have a very full hearing of some 14 witnesses, and that will be on three panels, so we're going to be somewhat restrictive in our timing.

I have a statement for the record submitted by Senator Hutchinson.

[The prepared statement of Senator Hutchinson follows:]

PREPARED STATEMENT OF HON. TIM HUTCHINSON, U.S. SENATOR FROM THE STATE OF ARKANSAS

Thank you, Mr. Chairman. Once again, I am grateful that you have seen fit to continue these hearings on the EPA's proposal to implement more stringent clean air standards for ozone and particulates.

Since the hearings began a couple months ago, we have had the opportunity to hear testimony where both sides of this complicated issue have been presented. When we began, I never expected this would be so complex and that there would be so many opinions, especially among the members of the President's Clean Air Scientific Advisory Committee. While I have come to expect politicians to disagree, I did not expect such disagreement among the scientists.

I am also somewhat surprised that there is so much opposition to the plan from within the administration.

There is opposition from the President's Council on Economic Advisers, the Office of Science and Technology Policy, the Department of Transportation, the Department of Commerce, the Small Business Administration, the Department of Agriculture and the Department of Treasury. These comments must be seriously analyzed and addressed before the rule is promulgated.

According to a Monday, April 21 story in the *Los Angeles Times,* one of these documents even suggested that if implemented, "the proposal could bring California's economic recovery to a grinding halt."

In Arkansas, we could face a similar fate. Recently, Arkansas has begun to see strong economic growth, especially in the Northeastern and Northwestern part of the State, yet investment may slow dramatically, even drop off completely, if these areas of growth fall out of attainment.

In the reauthorization of ISTEA, Arkansas may see a tremendous increase in access to transportation, as we work on proposals for construction on the I–69 International Trade Corridor (or interstate?). Yet, since the implementation of these standards could threaten highway funding, the timely completion of I–69 or other highways in Arkansas may be in jeopardy.

This week, the Arkansas State Chamber of Commerce was in town to meet with the congressional delegation and other national leaders. The issue that is overwhelmingly the most important to these leaders is the completion of I–69.

Considering the scientific weaknesses surrounding these standards, the disagreements within the Clinton Administration and the opposition from so many of my constituents and State leaders, I am not comfortable sacrificing any funding for one of the most important economic facilitators in the history of Arkansas.

Mr. Chairman, today, State Representative Scott Ferguson of West Memphis, Arkansas was supposed to testify before our committee regarding his opposition to the proposed standards.

Unfortunately, because of family and business considerations, Representative Ferguson could not be with us. I would like to read a few of the excerpts from his testimony and have the entire testimony placed in the record.

I feel it is important to note that Representative Ferguson is a Medical Doctor and is a member of the Public Health, Welfare, and Labor Committee in the Arkansas House of Representatives.

Dr. Ferguson cosponsored a resolution in the Arkansas House, which was passed along with a companion resolution in the State Senate, stating that the EPA should retain the current standard for ozone and retain the current standard for PM_{10}, until more research can be done on $PM_{2.5}$. I would like these two resolutions to also be placed in the record.

Dr. Ferguson goes on to say, "As a medical professional and an elected official, it concerns me that policymakers want to move forward with these standards prior to a complete analysis of these issues."

Mr. Chairman, I know there are other doctors on the panels today who will be testifying, but I hope Dr. Ferguson's testimony will also be seriously considered as we proceed today and through the next few months.

I thank the Chairman again for calling this hearing.

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I thank the Chairman again for calling this hearing.

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DISTRICT 96
Part of Crittenden County

STATE OF ARKANSAS
House of Representatives

COMMITTEES
MEMBER
Public Health, Welfare and Labor
Aging and Legislative Affairs
Joint Performance Review

Testimony of
Dr. Scott Ferguson
State Representative - District 96
Arkansas House of Representatives
Before the
Committee on Environment and Public Works
Subcommitee on Clean Air, Wetlands, Private Property, and Nuclear Safety
United States Senate
April 29, 1997

Good Afternoon, Mr. Chairman and members of the Committee. My name is Dr. Scott Ferguson. I currently represent District 96 in the Arkansas House of Representatives, serving my 2nd term in office. This District includes West Memphis and part of Crittenden County. I am a resident and also a practicing Radiologist in West Memphis, Arkansas.

Thank you for the opportunity to provide testimony for consideration by this committee as it conducts oversight hearings on EPA's Proposal to Revise the National Ambient Air Quality Standards (Air Standards) for Ozone and Particulate Matter and the impacts that these proposed changes may have on our state and, more specifically, the local area of Crittenden County and the City of West Memphis, AR.

As a member of the Public Health, Welfare, and Labor Committee in the Arkansas House of Representatives, I co-sponsored, along with Jim Magness, State Representative from Pulaski County, a Resolution in the Arkansas House of Representatives related to the proposed standards. A duplicate resolution was passed by the Arkansas Senate under the sponsorship of State Senator Mike Bearden, who also represents a portion of Crittenden County. Copies of these resolutions are provided to be entered as part of this hearing's record, if so allowed by the Committee.

The resolutions passed by our 81st General Assembly urge EPA to retain the current ozone standard and to delay adoption of a fine particulate standard until more information, including monitoring data is available. I, like others who have testified before me, cannot discuss the possible impacts of the proposed fine particulate standard without knowledge of what the emission levels are in Crittenden County or the surrounding area. Likewise, I am aware there is not concurrence on the health benefits and the type of control measures which will be effective. As a medical professional and an elected official, it concerns me that policy makers want to move forward with these standards prior to a complete analysis of these issues.

The remainder of my comments are related to the possible impacts of proposed revisions to the ozone standards. Prior to that discussion, let me provide you a brief introduction to Crittenden County and West Memphis.

As the name implies, West Memphis is located across the Mississippi River and due west of Memphis, Tennessee. It is the center of population for Crittenden County. Crittenden County is a relatively small segment of a consolidated metropolitan statistical area that includes several counties in Tennessee, Mississippi, and Arkansas. Evironmental regulations are administered by two EPA reginal offices and at least four different and autonomous state and local agencies.

An ozone monitor located in Crittenden County, Arkansas, shows occasional ozone concentrations high enough that on-going attainment of the current standard is unlikely and compliance with the proposed standard practically unachievable in the near future. We are concerned about the health effects of these relatively high concentrations. Data suggests that these concentrations in mostly rural eastern Arkansas are primarily due to two factors. The first is the influence of the overall metropolitan area of Memphis, Tennessee. The second is the development of this regional area into a national transportation and shipping hub. We are at a loss if it comes to Arkansas being required to develop an effective plan to reduce and control the ozone concentrations in East Arkansas. The fact that ozone concentrations in a particular area are higher than allowed should not itself be used as justification to impose extensive control measures when it is apparent that the effort would not result in measurable gains in air quality.

Let me give you some specific information which are the basis for these comments:

From information provided by the Arkansas Department of Pollution Control and Ecology, an inventory of sources performed in 1990 showed that point sources and mobile sources in Crittenden County accounted for less that 7% of the total emissions in Memphis MSA. In fact, the total emissions from all sources in Crittenden County are less that one of the point sources identified in Shelby County, Tennessee. With the convergence of two major interstate highways (40 and 55) in West Memphis, greater than 60% of the road use in Crittenden County is on interstate highways. In Shelby County, only 21% or the road use was determined to be on interstates with the remainder a result of local traffic sources.

Memphis has demonstrated success in reducing ozone levels. This was done utilizing mandated programs in Shelby County. This was achieved without local controls in Crittenden County. We support continued programs in Shelby County to reduce ozone levels by controlling significant sources. As a result of a prior designation of non-attainment, Shelby County, Tennessee has a "maintenance program" in place that effectively prevents it from being redesignated to non-attainment on the basis of new violations. New Shelby County violations would require existing contingencies to be implemented as a condition to retaining the "attainment by maintenance" designation. This plan is maintained and administered by the county agency in Tennessee. Arkansas has no "oversight mechanism" for assuring that the existing control plan will result i area-wide benefits. If Crittenden County is redesignated to non-attainment on the basis of monitoring data, there would be no recourse but to seek additional reductions from both Tennessee and Mississippi sources.

As statistics above demonstrate, the largest percentage of mobile sources are not local but interstate traffic passing through or "drive-by" emission sources. Rather than local controls which have been effective in Memphis, Crittenden County must rely on national or regional programs such as automobile emission standards, mass transit, alternative fuels, etc., to find effective reductions. Similar to the Memphis ozone transport situation, Crittenden County has no mechanism to assure these programs will be implemented in a manner benefiting our local area.

Our economy is strongly dependent on the transportation industry, industrial development, small business, and rural farming activities. We are concerned about the possibility of road construction bans, loss of highway investment and development, controls on existing business (most of which are small businesses), and the immediate halt to new industrial/business development which could occur with reclassification of the Crittenden County area as non-attainment. We agree with Senator Bumpers from Arkansas who has urged EPA to conduct additional analyses of the potential impacts as required by applicable legislative actions in addition to the Clean Air Act. While I support measures to benefit the health of citizens of my community, particularly high risk individuals, I am concerned that the negative implications of these standards will result in reality a lower level of health care overall as a result of loss of employment and economic opportunities in what is already a depressed economic area.

I suggest that, rather redesignating Crittenden County, it would be more appropriate to re-evaluate the effectiveness of national measures as well as the existing control plan for the Memphis MSA and whether it will result in future reductions in area-wide ozone concentrations. If Crittenden County is required to plan for and achieve reductions, the extent of reductions required should not exceed the relative contribution to the area-wide emissions. I am confident the citizens of Crittenden County will participate in appropriate programs where our involvement can be demonstrated to be beneficial.

The need to develop new control strategies in Eastern Arkansas would require program efforts beyond current committments. While Arkansas will attempt to cooperate in new standards implementation, it will have to be carefully weigh the costs of implementation against the potential for success of its efforts before committing to a plan of action.

Metroplan, a local metropolitan planning agency in Central Arkansas, plans to initate an "Ozone Action Day" program that will inform corporate and private citizens on voluntary measures that can be taken to prevent excessive ozone concentrations on days when exceedance of the ozone standard is likely. The success of this sort of program is largely dependent on the active participation of an informed community. The education and communications are largely through regional media outlets, which for Crittenden County are located in Tennessee. I am very interested in measures that our area can take to achieve improved air quality before, or even without, new federally mandated programs. I encourage Memphis to implement a similar program that West Memphis could take an active role in and have been assured that ADPC&E will support any such effort.

Thank you,

Scott Ferguson
State Representative District 96

cc: Congressman Marion Berry
Congressman Vic Snyder
Congressman Asa Hutchinson
Congressman Jay Dickey
Senator Tim Hutchinson
Senator Dale Bumpers
President William J. Clinton

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S.R. 7

State of Arkansas
81st General Assembly
Regular Session, 1997 S.R. 7
By: Senator Bearden

SENATE RESOLUTION

CONCERNING PARTICULATE MATTER RECOMMENDATIONS.

Subtitle

CONCERNING PARTICULATE MATTER RECOMMENDATIONS.

WHEREAS, the U.S. Environmental Protection Agency (EPA) is considering changes to the National Ambient Air Quality Standard (NAAQS) by tightening the ozone standard and adding a separate particulate matter (PM) standard for PM2.5 to the existing PM10 standard; and

WHEREAS, the American public enjoys better air quality today than at any time in decades, including a 20-percent decline in average PM10 concentration between 1988 and 1994, and a 12-percent reduction in PM2.5; and

WHEREAS, air quality will continue to improve as the levels of ozone and particulate matter continue to decrease under the current regulations, and levels of fine particulate precursors (sulfur dioxide, nitrogen oxide, volatile organic compounds) are projected by EPA to decline by over 11 million tons between 1990 and 2000; and

WHEREAS, there is no existing PM2.5 ambient air monitoring data for Arkansas; and

WHEREAS, current research indicates that there are many unanswered questions and uncertainties on this issue and the need for a more stringent standard, including: Divergent opinions among scientists who have investigated this issue; the lack of supporting toxicological data; the lack of a plausible toxicological mechanism; the lack of correlation between recorded levels and public health effects; and the influence of confounders.

WHEREAS, the EPA s Clean Air Science Advisory Committee (CASAC) concluded "that there is no bright line which distinguishes any of the proposed (ozone) standards as being more protective of public health"; and

WHEREAS, no scientific proof exists that tightening controls on PM2.5 and ozone would avoid alleged adverse health effects, while costs would assuredly be high; and

WHEREAS, the additional PM2.5 standard and lower ozone standard being considered would result in many additional nonattainment areas and emission controls in the State of Arkansas, including many rural communities, and would impose a significant economic, administrative and regulatory burden on the citizens, businesses, state, and local governments without commensurate air quality benefits.

NOW THEREFORE,
BE IT RESOLVED BY THE SENATE OF THE EIGHTY-FIRST GENERAL ASSEMBLY OF THE STATE OF ARKANSAS:

THAT the U.S. Environmental Protection Agency retain the existing NAAQS for ozone; and

THAT the U.S. Environmental Protection Agency reaffirm the existing PM10 standard and conduct the additional scientific research needed to answer critical causality and other questions before a proposal for a new PM2.5 standard is made; and

BE IT FURTHER RESOLVED that due to remaining uncertainties and the lack of causality between PM2.5 and adverse health effects, that EPA should abandon its current consideration of a PM2.5 standard until more information, including sound science and cost-effectiveness data are available; and

BE IT FURTHER RESOLVED that the Arkansas Senate urges EPA to identify any unfunded mandates or other administrative and economic burdens for state or local governments or agencies that would derive from changes to the National Ambient Air Quality Standards for Particulate Matter.

BE IT FURTHER RESOLVED that the Secretary of the Senate shall forward copies of this Resolution to the Administrator of the U.S. Environmental Protection Agency and to all members of the Arkansas congressional delegation.

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H.R. 1011
As Engrossed: H2/21/97

State of Arkansas

As Engrossed: H2/21/97
81st General Assembly
Regular Session, 1997
H.R. 1011
By: Representatives Ferguson and Magnus

HOUSE RESOLUTION

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Subtitle

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That the U.S. Environmental Protection Agency reaffirm the existing PM10 standard and conduct the additional scientific research needed to answer critical causality and other questions before a proposal for a new PM2.5 standard is made; and

BE IT FURTHER RESOLVED that due to remaining uncertainties and the lack of causality between PM2.5 and adverse health effects, that EPA should abandon its current consideration of a PM2.5 standard until more information, including sound science and cost-effectiveness data are available; and

BE IT FURTHER RESOLVED that the House of Representatives urges EPA to identify any unfunded mandates or other administrative and economic burdens for state or local governments or agencies that would derive from changes to the National Ambient Air Quality Standards for Particulate Matter.

BE IT FURTHER RESOLVED that the Chief Clerk of the House of Representatives shall forward copies of this

Senator INHOFE. I would now ask for the first panel of witnesses to be seated at the witness table. The way we've divided up the panels today is to start with the witnesses from State and local governments. The second panel and third panels will consist of other interested parties.

While they're coming forward taking their chairs, I'd like to give you an overview of how we'll proceed during this public hearing.

We have 14 witnesses who will be testifying today. As I also mentioned to you, some other members of the subcommittee couldn't be here today. Some of their staff is, and some will be coming in later on.

Each witness will be given 5 minutes to give his or her opening statement. Your entire statement is already submitted for the record, and I appreciate the fact that you have already done that.

We will use these little lights up here that we normally don't adhere to at all that closely, but since we have so many witnesses today we will. I think we all know what red, yellow, and green mean.

Following each of the 5-minute comments by the witnesses, we'll ask each member of the subcommittee to ask questions and we'll have a round of questions and answers.

The first panel will be: The Honorable Mayor Emma Hull, mayor of Benton Harbor, Michigan; The Honorable Richard Homrighausen, mayor of—you know, I always thought in politics it's easier to have an easier name. It hasn't worked out too well, of course—mayor of Dover, OH; The Honorable Leon G. Billings, delegate, Maryland General Assembly; The Honorable Richard L. Russman, New Hampshire State Senate; and from my home town, The Honorable John Selph, Tulsa County Commissioner, Tulsa, OK.

With that we'll go ahead and start with Mayor Hull.

STATEMENT OF HON. EMMA JEAN HULL, MAYOR OF BENTON HARBOR, MI

Mayor Hull. Thank you, Mr. Chairman and members of the committee.

My name is Emma Jean Hull, mayor of Benton Harbor, MI, and a member of the National Conference of Black Mayors' Standing Committee on Environmental Justice.

Benton Harbor is located on the shores of Lake Michigan just an hour east of Chicago, IL, and 45 minutes from Gary, IN. It is a minority/majority community with a population of 12,818, 97 percent African-American, 40 percent under the age of 18.

Benton Harbor, through a local partnership with businesses and industries, is just beginning to address some of the Nation's highest at-risk factors in crime, unemployment, and school dropouts. Our success to date relies on local initiatives to retain, attract, and grow small businesses, address work force development, and deal with environmental concerns—mostly related to our brownfields redevelopment projects.

In the late 1970's and early 1980's, Benton Harbor saw the loss of over 3,000 manufacturing jobs, with major plants closing in the steel appliance and automotive industries. The remaining empty, deteriorating, and in some instances contaminated buildings

formed both the core of our environmental problems and Benton Harbor's redevelopment potential.

With passage of the 1990 Clean Air Act and the establishment of that year as a baseline for attainment, my city was put at an immediate and distinct disadvantage. In the late 1980's and early 1990's, Benton Harbor was at its lowest point in its history for industry activity. This artificial low standard for air quality applied nationally without regard to local circumstances is magnified by a proximity to both Chicago and Gary and the prevailing westerly wind—a fact that impacts the expansion of existing businesses and inhibits the location of new businesses in Benton Harbor, as well.

Benton Harbor was one of only 11 communities chosen by Governor Engler for a new innovative project called "Renaissance Zone Designation." At the hall mark of our application was a program to redevelop the old brownfield sites that used to be the home of thousands upon thousands of steel and heavy manufacturing employment.

The loss of these jobs has crippled the economy of Benton Harbor, and the redevelopment of these acres will not only improve the quality of life for all of our residents, but greatly enhance the environment through a long-term redevelopment strategy.

The local community and the State government have agreed to give up all taxes on any development on this property for 10 years. That's right—no property tax, no income tax, no utility tax, no State or local taxes of any kind if these brownfield sites are redeveloped.

Located adjacent to Lake Michigan, the redevelopment of these sites is crucial to bring about an harmonious balance between environmental protection, economic activity, and improved quality of life for our citizens.

This innovative piece of legislation has been highlighted in such publications as "The Wall Street Journal," "The New York Times," and, as a result, the number of businesses seriously considering location in our community is at its highest level.

The proposed most stringent ozone standards and new PM standards for particulate matter emissions, if implemented, will directly impact on my community's effort toward sustainable economic growth and development.

The Renaissance Zone is just one example of how the local government has cooperated with the business leaders and State legislators in creating a long-term visionary plan for redeveloping our community.

The change in the air emission standards will only undermine this bold and innovative approach to economic development.

Furthermore, these new restrictions take away opportunities from the people who need it most. They are not responsible for the air emission coming from Chicago and other areas across Lake Michigan, nor are they responsible for the time chosen to be the baseline for the Clean Air Act when we, as a community, have fallen on our worse times ever.

These new proposed standards would unfairly harm a special group of individuals. The small businesses affected, many for the first time, like printers, bakers, service station operators, and construction firms—are the foundation of the growing ranks of Benton

Harbor's minority entrepreneurs. The anticipated high production and operation costs required by the proposed standards, coupled with the regulatory burdens, can restrict these businesses' expansion, impact their capital expenditures, and eventually affect the jobs of many of our community residents. This problem is only magnified when applied to the new larger businesses.

The ability to attract new, major business and industry to brownfield sites is difficult. Benton Harbor and the Nation does not need any additional impediments.

Mr. Chairman, many of the old industry sites of Benton Harbor are examples of the shift which will occur as part of our new proposed air emission standards. Businesses and heavy manufacturing left our area to find new greenfield sites.

Undermining the efforts being made by our community to start new businesses and attract new industry to redevelop brownfield sites will all be undermined by the new proposed air emissions standards.

Those new investments and job opportunities so desperately needed in our community will not occur. Rather, they will occur at other greenfield locations throughout the country that are not unfairly being impacted by the air emission standards.

It is perhaps the cruelest irony of all that Benton Harbor made a name for itself as a community of thriving manufacturing base, only to lose the opportunity to regain its reputation because of the air that emits from Chicago and from our having had such low artificial standards imposed upon our community.

Partnership is a requirement of change, and that partnership must include the Federal Government, local community, and the business community, and policymakers at the State level working together.

I propose to you that the initiative underway in Benton Harbor will improve the economy, as I come to a close, but also drastically enhance the environmental surroundings of our area.

Brownfield redevelopment is desperately needed in our area, as it is across the country. Changing our standards will only undermine many of those far-reaching initiatives, and you policymakers must balance what is in the best interest of all parties concerned.

I propose to you that an intelligent true partnership that involves all of us in the way to protect the environment while also changing the social fabric of the community, like Benton Harbor—please consider the impact the proposed changes will have on the local partnership my community so desperately needs.

Thank you for this opportunity to address this matter today.

Senator INHOFE. Thank you, Mayor Hull.

Unfortunately, there is a vote taking place right now. Mayor Homrighausen, if you would proceed, I will run and vote and come back.

I have read your testimony very carefully. Having been a mayor, I wanted to see what other mayors were thinking in some of the problems.

So if you'd go ahead and give your testimony, I will be right back and we'll have that in the record.

[The chairman vacated the chair.]

STATEMENT OF HON. RICHARD P. HOMRIGHAUSEN, MAYOR OF DOVER, OH

Mayor HOMRIGHAUSEN. Good afternoon. My name is Richard P. Homrighausen, and I am mayor of the city of Dover, OH. I appreciate the opportunity to testify before you this afternoon on EPA environmental proposed rules of increasing the stringency of the air quality standards for ozone and particulate matter.

In my comments I hope to convey to you the perspective of one middle America community on the potential impact of EPA's proposed rules.

In addition, I will represent the perspective of the city of Dover Electric System, a small, municipally-owned utility that will likely be seriously impacted by EPA's rules.

Finally, I am here today representing the city of Dover's utility trade association, the Ohio Municipal Electric Association, which represents 79 public power systems in Ohio, all of whom are concerned about the potential impact of EPA's rules on these small, community-owned business entities.

Cities like Dover and public power systems like the Dover Electric System are significantly concerned about the negative impact that EPA's proposed ozone and particulate matter rules could have on local governments and public utilities. The EPA has proposed air standards which it acknowledges will not be achievable for many communities and which will have a drastically disproportionate impact on small utility systems and the communities which we serve.

These disproportionate costs and impacts that may be imposed upon small entities have not been adequately addressed by the EPA, which compounds the inadequate science and health data on which EPA has based its drastic new standards.

So I hope that I can convey today that these disproportionate impacts the rules may have on small communities and business entities will be ultimately placed on the citizens and consumers served by cities like Dover and public power systems like those represented by OMEA.

Therefore, the city of Dover and the Ohio Municipal Electric Association call upon Congress to ensure that, first, the EPA performs a full assessment of the potential costs and impacts of the proposed ozone and PM rules on small business entities and local governments, including public power entities, prior to the finalization of the standards and their implementation.

Second, Congress should require that EPA devises a plan to ensure no disproportionate impact from its ozone and PM rules on small communities and public power entities.

Third, Congress should ensure that EPA devises an implementation plan for any new standards that provides the technical assistance and regulatory flexibility to small public power plants that will be necessary for these systems to comply with any burdensome new regulations.

And, fourth, the Congress should statutorily exempt small utility units—that is, utility units that have 25 megawatts of capacity or less—from additional regulatory requirements, just as the Congress exempted small utility units from the title four control require-

ments for the acid rain program under the Clean Air Act amendments of 1990.

I'd like to give you a brief background on Dover's Electric System and public power in Ohio so that you can understand the context in which EPA's rules will apply.

The city of Dover, located in Tuscarawas County in the northeastern portion of Ohio, has a population of 13,000. Local employment is supported by 55 diversified industries county-wide. This includes the city of Dover Electric System, which serves 6,185 customers and consists of a coal-and gas-fired electric generation plant, an electric distribution system, and electric transmission interconnections.

The Dover Electric Power Plant has instituted substantial environmental control measures in recent years, including an electrostatic precipitator and natural gas co-firing burners to reduce particulate emissions.

I might add that the natural gas co-firing burners were the first of this new technology to be installed in an electric utility in the United States.

The city's electric system plays a vital role in the competitive sale of power to Ohio customers, supplying relatively low-cost energy to our customers. Public power systems in the United States which are community owned, locally controlled, and not-for-profit serve one in seven Americans, or 35 million people, and collectively possess $77 billion in investment in all types of generating capacity.

Public power is inherently accountable to communities and their citizens because they are owned and governed by these communities. That is why public power stands for the development of a viable competitive wholesale electric market, improved environmental quality, and the protection of the public interest against market power abuses.

Public power is disproportionately burdened by regulatory requirements like EPA's proposed rules. Public power utility generators like Dover's tend to be smaller and older than investor-owned systems and units. These smaller public utilities often suffer from dis-economies of scale and bear particular burdens from technology-forced requirements which would probably result from EPA's proposed rules.

A number of adverse impacts could result for communities and public utilities from EPA's rules, including: communities, including Dover, would likely be thrown into ozone and PM nonattainment by the proposed EPA rules. As you know, nonattainment status can lead to burdensome regulatory requirements, as well as discourage the economic development and revitalization of our cities, as Mayor Hull previously mentioned.

That only pushes businesses that wish to avoid nonattainment requirements into our Nation's green spaces. Electric utilities like Dover's may be subject to stringent technology forced requirements, such as selective catalytic reduction technology. Expensive SCR technology would be a particular hardship to small utility units like Dover's 15 megawatt unit because the costs of the requirements cannot be spread over a large customer base, thus poten-

tially making power from small units uncompetitive on the eve of electric industry restructuring.

In addition, the EPA's regulatory impact analysis for the proposed ozone and PM rules acknowledge that the rules could have a drastically disproportionate impact on small business entities like Dover's small utility system.

As in my written comments, the EPA has estimated that the negative economic impact on EPA's proposed ozone rule will be three times greater on small utility units than it will be on all utility units. Likewise, EPA has estimated that its proposed PM rule will cause a significant economic impact on twice as many small entities when compared to all business entities.

So it appears that EPA's proposed rules could well lead to substantial burdens on small public power systems that could result in the shutdown of these plants on the eve of electric deregulation, a resulting loss of jobs, or, at the least, a substantial increase to the electric bills to the citizens, businesses, and other consumers served by cities like Dover.

For these reasons, the city of Dover and the Ohio Municipal Electric Association call upon the Congress and the EPA to assess the potential impacts of these proposed rules on communities and small businesses prior to their implementation and to ensure that no disproportionate burden is placed upon the citizens and consumers which we serve.

Thank you.

STATEMENT OF HON. RICHARD L. RUSSMAN, NEW HAMPSHIRE STATE SENATE

Mr. RUSSMAN. Thank you, Mr. Chairman and members of the staff and committee.

[Laughter.]

Mr. RUSSMAN. I appreciate your being here.

I guess as a Republican I can start with a quote of the day, if you will, from Senator John McCain at the fifth annual Green Bow, which he said, "When Republicans introduce bills to abolish the Clean Air amendment or dismiss valid environmental concerns as the ravings of partisan extremists, we give credence to our critics who question whether Republicans share the environmental values of the majority."

I have to tell you, coming from New Hampshire, that we think that the EPA proposals would be great.

As a beginning, I will tell you that if the proposed rule is finalized, approximately 15,000 lives will be saved annually. Now, if you just think about that for a moment, that seems like an awful lot of people to me. That's a city the size of our capital city of Concord, which is substantial.

I think, however, wherever you come from, that's an awful lot of people.

I wonder if, on the chart that the chairman showed earlier, that perhaps those deaths could be shown in black as opposed to red or green, and I wonder where they would stand on that chart that was shown.

To me it seems that the support for measures such as this that would save so many lives should be a no-brainer.

EPA's rule should be promulgated. I think the EPA should absolutely resist pressure to issue a weakened national ambient air quality standard.

Many of the proposed rule detractors would delay for 5 years while we wait for more research. Can you imagine? If you multiply that out, that's 75,000 potential deaths in the next 5 years. And even if it's only 50,000 or 25,000, think about that.

The elderly population is a population that is particularly stricken, and I'm sure that they would be interested to know their quality standards and seeing that they are implemented.

We often say, when we advocate delay, that too often justice delayed is justice denied.

As far as New Hampshire is concerned, our Department of Environmental Services is squarely on board in support of the standards. Our New Hampshire business community, Business and Industry Association, is squarely supporting the standards. And I, as chairman of the Senate Environment Committee for the State of New Hampshire, am here to support the standards. And I must tell you that many of the other States in the northeast support the standards, as well.

Let's face it, the Federal Government must set standards and the national government is in the perfect position to do so. Uniform minimum Federal standards must remain the cornerstone of our system of national environmental protection.

State citizens are particularly dependent upon that in terms of protection of their health to address the interstate migration and the effects of pollution.

Uniform minimal national standards are especially vital in areas of air pollution. Air pollution does simply not respect State boundaries. Federal health-based standards that provide minimum uniform protection for all of our citizens is a perfect State/Federal model that works and should be defended from any change.

Now, the EPA has set health-based air standards and the States devise approaches and strategies for obtaining those compliances with the standards. The EPA prescribes the ends, and we'll take the responsibility to devise the means and how to get there.

This Federal/State partnership allows EPA to establish safeguards that no State could accomplish alone and allows States to tailor implementation burdens in a way that best suits the interests of that particular State.

Air standards provide a model for environmental federalism and must not be changed. State citizens receive uniform national protection with locally tailored and sensitive State solutions, and we welcome that opportunity, certainly, in the next component.

Let's look at regional equity for a moment. In the northeast, in particular, we will benefit immensely from these particular standards. The ozone transport assessment group modeling demonstrates that ground-level smog, ozone, is transported great distances. Current science also indicates that particulate matter 2.5 fine particles also travel long distances because they stay airborne for so long due to their tiny size.

Therefore, to the extent these standards will induce our neighbors in the midwest to act responsibly and curtail their pollution

of our citizens' air, then these standards must be applauded and should be applauded.

As we know from our experience with acid rain, our neighboring States in the midwest and elsewhere would not do their fair share unless mandated by the Federal Government to do so.

I think that everybody else in this country would share the same view that people would all want to breathe clean air, and I doubt that there is anybody out there, when asked, that would say that they don't care to breathe clean air, and I suspect that if it was suggested that air be brought in here today for us to breathe for the duration of the afternoon, we probably wouldn't want to stick around.

The National Caucus of Environmental Legislatures—you'll receive a copy of this, Mr. Chairman, along with other members of the committee. It has been signed by members of that caucus from across the country; not just the northeast, but a number of other States, including people from the midwestern section of this country.

In closing, I would urge this committee to help and not be a hindrance in the EPA's attempt to avoid 15,000 unnecessary and avoidable deaths a year. For those in Congress who advocate a 5-year delay, remember the price is possibly 75,000 unnecessary deaths. Let us not forget that many of those unavoidable deaths will occur among the elderly.

For those who worry about their State's ability to implement the new standard, trust us. We have been in the business of pollution control as long as Congress, and we have learned a thing or two along the way, and the States, I can assure you, can handle it.

Thank you very much.

Senator INHOFE [resuming the chair]. Thank you, Senator Russman.

Mr. Billings, you will be next. But, before you begin, we have been joined by Senator Jeff Sessions from Alabama.

Senator Sessions, this is a panel of State and local—we have two mayors, State legislators, and, from the great city of Tulsa, OK, our county commissioner.

Would you like to make an opening statement?

OPENING STATEMENT OF HON. JEFF SESSIONS, U.S. SENATOR FROM THE STATE OF ALABAMA

Senator SESSIONS. Mr. Chairman, I would like to say a few things.

Senator INHOFE. Yes.

Senator SESSIONS. I want to thank you for calling these hearings. We did have an outstanding hearing in Oklahoma. Protecting the health of our citizens and maintaining quality air for our people to breathe is important.

The thing that's troubling to me is about whether or not these proposed increased standards that are proposed by EPA, whether or not they, in fact, will make the health of our citizens better.

It's not just the big businesses and those experienced in working with EPA regulations such as local officials who deal with that regularly who will be forced to make changes if the proposed standards are finalized; it's the farmer whose work might have to stop

when ozone or dust levels rise to high. It could be a critical time in his harvest or planting.

It's the struggling worker who drives an old car that may now not meet the standards, and even repairing it may not be worth the cost of the automobile.

It's the small business owner who may have to purchase costly emissions control equipment at the cost of not employing other people or expanding his business.

There is no one in public office who can be in local and county and city and State governments who is not committed to improving the air quality and the health of their communities. I know that. But it is remarkable that we have such a universal concern by those local government officials who will be implementing this. Their opinions, I think, are also based on their honest view of what the science is, and they are committed to improving the quality of the air.

So I am interested in hearing more from this panel. Senator Inhofe, I appreciate very much your leadership in raising this issue to the public's attention, because we do not need to make a mistake as we go forward.

Senator INHOFE. Thank you, Senator Sessions. I also appreciate the fact that you came out to Oklahoma for our field hearing, which was very, very well attended. We had several hundred people there.

Now, Mr. Billings, a delegate from the Maryland General Assembly. Mr. Billings.

STATEMENT OF HON. LEON G. BILLINGS, DELEGATE, MARYLAND GENERAL ASSEMBLY

Mr. BILLINGS. Thank you, Senator.

My name is Leon Billings. I represent the Kensington-Chevy Chase-Wheaton area of Maryland. I think I bring a unique perspective to the hearings as a State legislator and because I spent 12 years as staff director of this subcommittee when Senator Muskie was its chairman.

My constituents are very strongly committed to environmental protection. They care about the quality of the air they breathe. They also care deeply about the Chesapeake Bay. Both would benefit from these new standards.

Many businesses in Maryland believe that they are being required to make extra investments to control pollution because large industrial sources and power plants in other States are doing too little to control their emissions. They argue against further reductions in emissions in Maryland until something is done about big polluters to our west and south.

Thus, for the people of Maryland, these new standards have two important benefits: they will provide additional health protection for our citizens and for the Bay, and they could reduce the burden on Maryland businesses by more fairly allocating the responsibility for cleanup to the large sources in other States.

Mr. Chairman, in the 12 years I served this subcommittee, virtually every single environmental proposal we recommended to the Senate was met with the charge that it was too expensive. The rhetoric in today's debate is much the same.

What is new is the 271 peer-reviewed air pollution health studies EPA evaluated prior to proposing the new standards. What is new is there is so much science to support standards.

When the first air quality information was published, there was a crescendo of criticism regarding the adequacy of that data. Compared to today's information base, those critics were on sound ground.

Prior to 1970, ambient air quality standards were adopted by localities based on citizen input, local perceptions, and the threat of air pollution. That process proved unacceptable to industry because the standards adopted were often more strict than indicated by federally published data.

In 1970, the Nixon administration proposed and Congress adopted national ambient air quality standards. The decision to adopt national standards was widely advocated by the Nation's major polluters. They wanted to use Government science as the basis for air quality standards. They wanted EPA to adopt air quality standards. They wanted to avoid proliferation of differing air quality standards. They wanted those standards adopted in 90 days after enactment of the 1970 Clean Air Act.

I would hope this committee would tell them, the National Association of Manufacturers, the Citizens for a Sound Economy, and their allies in the anticlean air band wagon to quit trying to change the rules they helped make.

Their opportunity to affect the cost of achieving these standards will come in the implementation phase. We are currently in the information phase. The American people have a right to know the levels of air pollution which affect their health.

Congress has never compromised this right to know. Congress on two occasions has provided more time to implement health-based standards—in 1977 up to 10 years more, in 1990 up to 20 years more—but Congress has never bowed to pressure to compromise science. To do so would make a process of public health protection political rather than scientific.

The appropriate focus for this committee and the Congress will be to assure a balanced and timely implementation of the standards, recognizing economic needs of industry and the need of millions of vulnerable Americans for protection from the impact of smog. Congress has been doing that job for 30 years.

We have proved that we can have a healthy and growing economy while moderating the health impact of pollution, and we have done so without compromising the public's right to know what healthy air is.

Thank you.

Senator INHOFE. Thank you, Mr. Billings.

Commissioner Selph.

STATEMENT OF HON. JOHN SELPH, TULSA COUNTY COMMISSIONER, OKLAHOMA

Mr. SELPH. Thank you, Mr. Chairman.

Mr. Chairman and members of the committee, my name is John Selph. I'm a member of the board of directors of the National Association of Regional Councils, and I chair their Air Quality Task Force. I'm also chairman-elect of the Indian Nations Council of

Governments, which is the planning organization for the Tulsa area, and I chair their Air Quality Committee, as well.

On behalf of NARC, I appreciate your invitation to testify before the subcommittee regarding the proposed changes.

The National Association of Regional Councils represents some 300-plus councils of governments, consisting of cities, towns, and counties in metro and rural areas across the United States. These regions run the gamut from nonattainment areas to areas that have always been in attainment. My comments reflect the policy positions developed by NARC. They also draw upon my experience as a county commissioner in Tulsa, OK, and my academic background, which includes a master's degree in public health with an emphasis on environmental science.

Before I talk about EPA's proposed standards, let me tell you a little bit about Tulsa and our experience with air quality.

Tulsa County was a nonattainment area, as you know, Senator, until 1990. We've worked very hard to achieve attainment status, and our county did achieve attainment status prior to the Clean Air Act signing in November 1990. It was important for us to avoid the stigma associated with being on the EPA's "Dirty Air List," especially for economic development purposes.

Since that time we've worked even harder to maintain our clean air status, and while our efforts have been wide-ranging, perhaps most notable was the creation of a nationally recognized ozone alert program, which is really the Nation's first voluntary episodic emissions control program.

This program reflects our philosophy of seeking voluntary, common-sense measures that are most effective in improving air quality, rather than the command and control approach too often used by State and Federal regulators.

Let me say that both NARC and I, along with everyone else on this panel, recognize the importance of improving air quality, and we support actions to maintain and improve the health of all citizens when such actions are based on sound scientific principles.

In light of this we are especially concerned about the conflicting opinions of the scientific community regarding the scientific basis for establishing new ozone and PM standards. There appears to be no scientific consensus that changing the standards at this time will result in significant public health benefits. Indeed, the recently revised EPA exposure and risk assessment findings underscore this lack of consensus.

We believe that considerable additional research including epidemiological studies are necessary before new ozone and PM standards are promulgated. Specifically, future epidemiologic studies should focus on the interaction between different pollutants and whether these effects are additive, synergistic, or antagonistic.

The Clean Air Act has had a positive impact on reducing pollutants, thus improving air quality for all Americans. If EPA imposes its proposed ozone standards, the number of nonattainment areas in the Nation will increase dramatically, perhaps a threefold increase, according to EPA's estimates.

Assigning these areas as nonattainment does not necessarily equate to improving air quality within the regions. In fact, these existing nonattainment regions are having great difficulty in

achieving the current standards, so forcing a mid-course change at this time will only delay and disrupt both public and private initiatives designed to achieve the objectives of the Clean Air Act.

Furthermore, we are not convinced that the technology is in place, or worse, even close at hand to help meet these proposed standards.

With regard to the proposed $PM_{2.5}$ standards, we believe that EPA lacks sufficient scientific evidence to justify revising the existing PM standard. Although the scientific evidence does, indeed, suggest some preliminary correlation of health effects, it seems to be inconclusive.

Adding onto this is the lack of a monitoring system for $PM_{2.5}$, which further supports our concerns about adding this standard.

Our experience in Tulsa has shown us that the goal of improving air quality is both worthy and attainable if approached in a common-sense manner.

In addition to our ozone alert program, by formal agreement with the EPA and a host of local and Federal partners we have become the Nation's first flexible attainment region. This FAR agreement, as it is called, enables us to implement a locally crafted strategy to reduce emissions and gives us adequate time to evaluate the results before having to implement more stringent measures to meet our goals. This avoids the one-size-fits-all command and control approach.

When we are allowed to develop our own programs and local buy-in is assured, the willingness to commit the necessary financial and political capital to achieve results is much more readily accepted.

In conclusion, we believe that the potential impact is great and we must have more certainty and consensus before a major change such as this is initiated.

Progress is being made in improving air quality, and more will come if common sense and flexibility prevail.

I appreciate being invited to participate in the subcommittee's hearings. On behalf of NARC, we look forward to working with the committee in your important task.

Senator INHOFE. Thank you very much, Commissioner Selph. I appreciate very much your being here and the work you've done in our home town.

Mayor Hull, I appreciate very much your appearing here today. As a former mayor, as I mentioned before, I understand some of the problems that local officials are having to go through to try to achieve these changes in standards.

As I understand it, you're out of attainment under the current standards; is that right?

Mayor HULL. Yes.

Senator INHOFE. What all have—what additional things can you do, as mayor of your city, and working as you said you have been doing with the private sector and with the various levels and other political subdivisions? You outlined some of the things that you have done. You're still out of attainment. Now we come along and lower these standards or raise the standards. What more can you do? Have you thought about that?

Mayor HULL. As I looked at the new act, Clean Air Act, I thought what impact it would have on our community as we are struggling

right now to redevelop our community, to partnership, as I said in my statement, with the public sector, with the private sector to make a difference in getting jobs in our community.

Our county is 5 percent unemployment, and in our city we have 30 percent unemployment. What we are doing now, we are trying to—with the brownfield we have a lot of old service stations and sites that cannot be developed because we have the burden of the underground storage tanks that need to be removed that we do not have the finances to remove, and so we are seeking grants.

With the Renaissance Zone, where they won't have to pay taxes, we are hoping businesses will come in and redevelop these sites to provide job opportunities.

While, of course, I am committed to the health of our local citizens to have it better, there has been no scientific data to date to say that lowering the standards will make the health of our citizens better.

Senator INHOFE. Putting it in context with other problems that your city faces—crime and all this—would you say this is the greatest health hazard to your city?

Mayor HULL. Yes.

Senator INHOFE. I mean, would you say that your air—the status right now of your ambient air in your city——

Mayor HULL. No, no. It is not the greatest health hazard in our city at this time.

Senator INHOFE. I see.

Mayor HULL. As a matter of fact, we need jobs. We have high, high rate of black-on-black crime because of the fact that we do not have economic development. They are not working. We have a high school dropout rate. There are some jobs to go to. We need skills so that we can produce jobs in our community. We need economic development.

If this standard was passed, if these acts were passed, it would totally wipe out our community as far as economic development is concerned.

Senator INHOFE. All right. And would you consider—this just needs to be a yes or no question—these changes to be an unfunded mandate?

Mayor HULL. Yes. I was working with the Michigan Municipal League, and I was working with the act to stop the unfunded mandates.

Senator INHOFE. OK.

Mayor HULL. Because we as a community cannot afford unfunded mandates, and if this was implemented we would have to fund this, and that's a mandate that we cannot fund.

Senator INHOFE. Thank you very much.

Mayor Homrighausen, in your testimony you cover the additional cost to ratepayers in your city if the proposals go final. I noticed the percentage increase to consumers is approximately 25 percent because the cost to small utilities would be three times greater than large utilities.

I don't see how you can stay in business. And I'd ask the same question. Do you consider this to be an unfunded mandate?

Mayor HOMRIGHAUSEN. Absolutely. Absolutely. That was the point I was trying to make today. Small public power entities, of which Dover is one, 25 megawatt units——

Senator INHOFE. It's about one-seventh, I think, of the country is covered by these small——

Mayor HOMRIGHAUSEN. Correct. One out of seven people are covered by public power. We're small. We can't afford the disproportionate burden that these new requirements would require, and we've asked—we feel that the EPA must reassess their impacts of the rules on public power communities and prevent any disproportionate impact.

We just don't see where the sound science has been used, and we would just call for Congress and the EPA to reassess.

Senator INHOFE. All right. Thank you very much.

Mr. Billings, the Maryland State Legislature voted against the mandatory treadmill emissions test, subjecting them to possible EPA sanctions. That vote was about 2 to 1. I assume you were not in the prevailing side on that?

Mr. BILLINGS. I was not, Mr. Chairman.

Senator INHOFE. I hope that, during the course of these meetings that we have, that people realize that we're making an effort to get the information from people who are acting in a minority, which you are, of course, in your capacity.

What percentage of your legislative body would you say that you are representing in your statement today?

Mr. BILLINGS. On the issue of health standards, probably about 85 percent.

Senator INHOFE. On the——

Mr. BILLINGS. On the issue of mandatory dynamometer testing, probably 40 percent.

Senator INHOFE. Yes. All right. What about as far as the change in the national ambient air quality standards?

Mr. BILLINGS. I would say, if they were better informed than I've heard today, it would be on the order of 60 or 70 percent, but I haven't heard any information today that would lead to making them better informed.

Senator INHOFE. Mr. Russman, you talk about the fact that you are involved with small businesses during your testimony, and the fact that they would be adding small business implementation work group. What you failed to mention in your testimony is that they failed to follow the Small Business Review Act.

I think you're very familiar with that. A lot of people aren't. But that would require the EPA to state what the effect would be on small business prior to—before—proposing the rules.

What do you think the impact would be on small businesses or small entities? It's loosely defined.

Mr. RUSSMAN. Frankly, I think that the new standards would be a boon to small business and entrepreneurship and creativity among the people that would be affected. I think that our economy has blossomed and grown over the years with the standards that were in place, despite the cry that there would be catastrophe. I think, on the contrary, our Business and Industry Association, which is the largest business group in the State, has held hearings,

and we've taken testimony, and they are firmly on board with these standards.

Senator INHOFE. You were somewhat critical of the National Conference of State Legislatures for the action that they've taken or the position that they've taken on this. Are you equally critical of the U.S. Conference of Mayors, the League of Cities, the National Association of Counties?

Mr. RUSSMAN. I can only speak to the National Conference of State Legislatures. I'm the immediate past chairman of their Committee on the Environment, and, frankly, the notion that this is an unfunded mandate, the idea of giving out information on the value of clean air is no more an unfunded mandate than perhaps in New Hampshire the——

Senator INHOFE. Implementation is expensive, and you don't consider that to be an unfunded mandate?

Mr. RUSSMAN. I think that implementation will have to be looked at at the appropriate time, but my understanding was that we're looking at the health-based necessity of having new standards, sir.

Senator INHOFE. Mr. Selph, what is our current ozone? Are we at .09 now approximately?

Mr. SELPH. In Tulsa?

Senator INHOFE. Yes.

Mr. SELPH. Well, it depends on what area of the city you want to monitor. Actually, some of the prevailing winds coming into Glenpool, southern part of Tulsa, on an ozone alert day may be pretty close to .08, .09.

Senator INHOFE. Yes. You know, we have worked with this for a long time, and I have to admit you've done a lot more than I have at the local level, and you're considered to be the real authority there. Have you ever approximated the costs that have been incurred by the taxpayers of Tulsa County in the efforts that you have undertaken so far?

Mr. SELPH. Of course, all of the efforts in Tulsa have been voluntary. The refineries, for example, voluntarily reduced the Reid vapor pressure (RVP) of the gasoline; all the suppliers of gasoline—Sun, Sinclair, and everyone else—reduces that Reid vapor pressure. It's required to be 9.0 in its number, and they reduce it to 8.2. Sun, alone, told me this week that that's costing them between $300,000 and $400,000.

Senator INHOFE. Yes. It has been voluntary. Of course, that's, I suppose you'd say, an unfunded mandate to the business community, as opposed to the political subdivision.

Mr. SELPH. Well, certainly they recognize the benefits of staying in attainment, and they would like to stay in attainment, and realize that if Tulsa slips into nonattainment then the cost would be even greater than what it is.

Senator INHOFE. Yes. You have a master's in public health?

Mr. SELPH. Yes, sir.

Senator INHOFE. And you think this change would have a dramatic improvement on public health?

Mr. SELPH. I would like to think that it would; however, I've read a lot of the studies and reviewed a lot of the information that has been presented, and it's difficult for me to come to that conclusion. It seems to be so inconclusive at this point.

Senator INHOFE. You know, our first hearing was the science. You remember, Senator Sessions, it was the science hearing where we had the Clean Air Scientific Advisory Committee well represented, and I think even the proponents of the rule change said that scientifically we'd be looking at probably 5 years before we could really get in there.

Now I'm talking about in particulate matter, determining which particulate matter and which levels would be. So I think that's probably consistent with their answer.

Mr. SELPH. Sure it is, and you asked me about particulate matter of 2.5 in Tulsa. Frankly, I don't have a clue as to whether or not that's going to be a problem in Tulsa because we don't have a monitoring system. There are no monitors to tell us whether or not that——

Senator INHOFE. Don't feel bad. No one else does, either.

Mr. SELPH. I understand that. I understand that the EPA is testing those at a cost of around $10,000 per monitor.

Senator INHOFE. Yes, sir.

Senator Sessions.

Senator SESSIONS. Thank you, Mr. Chairman.

Mr. Selph, with regard to the CASAC scientific advisory study, are you aware just how close the vote was on those matters? I mean, the people who are advising EPA, who had a moral obligation to analyze the data in every study that was in and to make a call on it, split almost down the middle.

Mr. SELPH. Split almost down the middle. That's correct.

Senator SESSIONS. In some arguments, you could argue that there were more votes against the regulations than there were in favor of it.

I think, Mr. Billings, that's what concerns me. I'm prepared to support costly things if we can get a significant health benefit from it, but the numbers that I'm seeing and the reports that I read indicate some real divergence of opinion.

For example, there was a study in Birmingham on particulate matter that showed a bad effect from it. Someone else came back and ran the same numbers and they factored in humidity and there was no change in health.

So there are a lot of things that may be in that air on a bad ozone day other than just ozone and particulate matter. Would you agree with that, Mr. Billings, that maybe we don't know all we need to know yet?

Mr. BILLINGS. Well, clearly we don't know all we need to know. Thirty years ago, when we did the first standards, we didn't know all we needed to know. Congress didn't know all it needed to know in 1970. In 1970, 1977, 1982, and 1979 when EPA revised the ozone standard, they revised it upwards. And now they're saying that they went in the wrong direction.

So there's no such thing as finality in science. That's why, when Senator Muskie and Senator Baker and this committee unanimously adopted this policy, they made a decision to keep science separate from cost, because they wanted to get the best scientific judgment they could get. They assumed that they were getting a sound scientific judgment separate from these other issues that the chairman has raised.

Now, those issues are legitimate, but they are separate from the scientific judgment.

Senator SESSIONS. Let's talk about that. Let's really talk about that honestly on the table here.

I know that there is a belief that we need to keep science separate from cost. I believe that's correct. I think we need to scientifically know what kind of damage that we may get from bad air. All right. What about the ultimate decision to implement between multiple choices of making a community better to live in?

The mayors have to make—she's got a lot of choices. Maybe the sewer system is better. Maybe there are hazardous waste dumps. I mean, don't we have to, at some point before we make a final implementation, categorize just how much health advantage we get compared to just how much the cost is?

Mr. BILLINGS. You're absolutely right, and that's—in 1970——

Senator SESSIONS. How do you distinguish——

Mr. BILLINGS. In 1970 what the committee did—again in a bipartisan way—supported unanimously by the Senate, as well as the committee—was to set a deadline of 5 or 6 years to achieve the health standards. EPA was to promulgate the standards in 90 days.

Congress came back at the end of that 5- and 6-year period and said, "Lo and behold, we didn't do it. We established the urgency of the problem, but we didn't solve the problem."

So they said, "Well, we can give areas with sort of bad problems another 5 years, and those with really bad problems another 10."

And Congress came back in 1990 and they said, "We haven't gotten there yet. There are some areas where we've had enormous economic growth and so on."

So Congress, under the leadership of this committee, said, "We're going to give areas that are marginal, like Tulsa, we're going to take them out. We're going to let other areas have another 3 to 5 years and other areas will get 17 to 20 years."

So what Congress has done is, after it established the science, what the health standards are, then Congress has taken a very careful look at these cost issues and these implementation issues and these technology issues and said, "How long does it take, spreading our resources out so that we carefully spend our money, while at the same time balancing how much health we're going to protect, because every time we delay this for a year or 2 years of 5 years we are making a health decision, too." We're saying, "Those people who are not protected then are going to continue to be unprotected."

Senator SESSIONS. I appreciate that, and it is a difficult dilemma because we don't want to undermine health. But, as the air gets cleaner and as it continues to get cleaner, the burdens imposed by moving one notch lower and the health benefits from moving one notch lower—burdens get higher and the benefits get a little less. I think we're reaching that area, it seems to me.

Mr. Selph, you mentioned your situation there, and you talked about the winds blowing into Tulsa. Were you saying there's a natural effect of ozone in your area, or is that——

Mr. SELPH. We think that there are some biogenic factors at work, whether it's from old oil fields in the southern Tulsa County

area or whatever the sources may be, but certainly they have an impact on the levels of ozone in that area.

If I could, I'd like to go back to something that you said earlier about the study that was done and the effect of humidity.

Certainly there are other factors at work, and that's why I suggested in my testimony that future epidemiological studies should look at the interaction effect that these co-pollutants have on each other, because sometimes they are additive—in other words, one plus one equals two. If you mix ozone with sulphur dioxide, for example, you may get an additive effect. Or you may get what's called a "synergistic effect," where one plus one equals three. You have a more serious effect. Or it could be antagonistic, where one plus one equals zero, where they cancel each other out.

Those type of things are difficult to research, but they do need to be researched.

Senator SESSIONS. I think that's right. I know in the case of asbestos and tobacco, the combination—the cancer from tobacco and the cancer from asbestos add up to 8 or 10. It's the synergistic effect. So I think that's a good observation.

One of the studies that we had was from New York about hospital admissions for asthma, and the numbers showed that there was something like a 1 percent increase in hospital admissions for asthma attacks on a bad ozone day.

The chairman or some member of the committee had a scientific journal study that analyzed the problems that you have with these kind of analyses in public health and concluded that if the number didn't get to 2 or 3 percent you really didn't have a very good basis to take action.

As a scientist and public health student, do you see a danger in making major decisions on data just that small?

Mr. SELPH. Well, I do, and those are certainly difficult decisions. And certainly if your family is of that 1 percent you might look at it from another perspective. But in terms of having what we consider to be significant findings, you really have to look at results that are greater than that.

Senator SESSIONS. I'll just point out that the odd thing on the asthma is that ozone levels have been falling nationally for some time and asthma attacks are going up. I don't think there's any study now that can tell us what's causing it. It may be something entirely different.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator.

Before you got here I went over the—if you'll remember, the last time we were in this room Mary Nichols was the one who answered my question in the negative when I was talking about the cost and the benefit. I think it was just a mistake on her part, but this is—I think you have one of these, and this kind of answers some of those questions as to the cost and benefit.

I want to thank all of you for coming. It's necessary to have a lot of meetings because we want input from everyone.

Your entire statements will be entered into the record and we are going to be submitting questions to you in writing, and we'd like to have you respond because we want to hear from everyone.

I hope, Mr. Billings' and Mr. Russman's appearance here, when really you're representing somewhat of a minority position, although you argue that it's not as well-informed out there as it should be, nonetheless, we are making an attempt to get everyone in here with all views.

We appreciate very much your coming today and will appreciate your continued cooperation in responding to our questions so we can come up with the right conclusions.

Thank you.

And now I ask our second panel to come to the table. The second panel consists of: Robert Junk, president of the Pennsylvania Farmers Union on behalf of the National Farmers Union; Mr. Bob Vice, who is the president of the California Farm Bureau Federation for the American Farm Bureau Federation; Mr. Paul Hansen, executive director of the Izaak Walton League of America; Dr. Kevin Fennelly, medical doctor, staff physician, the Division of Environmental and Occupational Health Sciences, National Jewish Medical and Research Center; and Dr. Christopher Grande, executive director of the International Trauma Anesthesia and Critical Care Society.

Welcome to all of you. I would say to our two witnesses, our two experts representing some of the agricultural concerns, that I've spent a lot of time throughout western Oklahoma and throughout southern Oklahoma in our ag communities to find that there is a great deal of concern from both the Farmers Union, the Farm Bureau, and their members.

We'll start off with Mr. Robert Junk, the president of the Pennsylvania Farmers Union.

STATEMENT OF ROBERT C. JUNK, PRESIDENT, PENNSYLVANIA FARMERS UNION, FOR NATIONAL FARMERS UNION

Mr. JUNK. Thank you, Mr. Chairman.

Good morning, Mr. Chairman and members of the committee. My name is Robert Junk. I am the president of the Pennsylvania Farmers Union. I'm also a member of the board of directors of the National Farmers Union and appear here today on behalf of the National Farmers Union.

The National Farmers Union is a general agricultural organization representing 300,000 family farmers and ranchers. We thank you for the opportunity to comment on the proposed changes of air quality standards and emissions of particulate matter.

The National Farmers Union has a long history of supporting conservation programs because the family farmers, as stewards of the land, are concerned about the environment. Significant levels of emissions are already controlled because farmers and ranchers are using good soil and water conservation practices and are keeping their equipment in good operational condition. It is simply in their best interest to do so because they seek to preserve the land to pass on to future generations.

The National Farmers Union is concerned that the proposed changes to the air quality standards for fine PM and ozone will greatly increase the regulations of farm operations and increase costs to farmers, both directly and indirectly. We are additionally

concerned that there is currently no funding in place to offset these costs other than what farmers will be required to pay.

At this point in time, I would like to summarize the rest of my testimony for means of time.

I think there are three points that we have to look at when we are addressing the proposed changes here. We need realistic goals based on sound science. For example, Paul Johnson, head of the NRCS, made a comment: "We believe and will coordinate research programs, and Federal, State, and local participation is necessary in order to begin answering these questions."

I think it is important that we take a look at that whole issue because of the fact that, again, we have to establish realistic goals. What is something that we can achieve? And then also it has to be based on the sound science that supports to achieve those goals.

I think the next issue we need to take a look at is a practical model. I think we're all aware of the Clean Water Act. The Clean Water Act has accomplished a number of different things out there today, and one of the biggest things that the Clean Water Act has incorporated out there in the agricultural community is the outreach in education to farmers.

I think what we need to do is take a look at how the conservation districts, along with the States, can partner together to provide this adequate information to deliver to the farmers to give them their practical practices that can be done to achieve some of the standards that we would like to see in clean air.

A little bit back in history of myself, currently I serve on the Chesapeake Bay Advisory Committee in Pennsylvania, and am the vice chairman of the Agricultural Advisory to DEP. Both of those agencies are working on water quality.

Again, I reach out to the fact that one of the basic problems we are having here with the air quality standards is the fact that we are not doing the outreach and education that we have done currently under the water quality issue. I think it is important that we take a look at that.

I think the other area that we need to—the third point that I would like to talk about is the Federal funds to achieve goals, basically making it a priority, not just for one agency but for all relative agencies. I think we need to, again, work for partnershiping to assure that the funding is there to help achieve our goals.

For example, one of the biggest issues I think we're facing is retrofitting old and new equipment—the clarification between what is new and what is old when we go looking at these new standards coming into place. How do we associate a new tractor that was just purchased, and now we have these standards? Who is responsible for making that tractor comply with the new regulations?

It's very costly. Farmers today have a difficult time being able to pass these additional costs on out of their products. It's important that we continue to look at that.

One other comment real quick I'd like to make is dealing with the USDA. The Department of Agriculture questioned EPA's proposed standards on PMs and charged that the new standards are not based on adequate scientific evidence and would have a large economic impact on tens of thousands, if not hundreds of thousands of small business farms. I think that is a very important issue.

In Pennsylvania we have a very heavy urban-based community. Also, we have farms right outside of these urban areas. We are suppressed by urban sprawl.

If these new standards go into place, these emission standards may not even be coming from the actual farm community, but the actual farm community would have to abide by the same standards.

So, in conclusion, at this point in time the National Farmers Union would encourage no changes within the standards until we have some good scientific base to back up these changes, along with being able to identify the source point.

Thank you very much.

Senator INHOFE. Thank you very much, Mr. Junk.

We've been joined by Senator Baucus.

Senator Baucus, would you like to have an opening statement?

Senator BAUCUS. No. Thank you very much, Mr. Chairman.

Senator INHOFE. All right. We've just completed our first panel, which was mostly county, State, and city officials.

Mr. Vice.

STATEMENT OF BOB VICE, PRESIDENT, CALIFORNIA FARM BUREAU FEDERATION, FOR AMERICAN FARM BUREAU FEDERATION

Mr. VICE. Thank you, Mr. Chairman, Senator Sessions, Senator Baucus. Thank you for the opportunity to be here today to testify before this committee on a very important issue—air quality.

I am Bob Vice. I'm a farmer from southern California. I raise avocados and citrus in Fallbrook, north San Diego County. I'm the president of the California Farm Bureau Federation, and today I'm representing the American Farm Bureau Federation, of which I serve on the board of directors. It's the Nation's largest general farm organization, with more than 4.7 million members nationwide.

I'm pleased to have the opportunity to discuss with you today the impact that the new air standards would have on the agricultural community.

My comments focus primarily on the Environmental Protection Agency proposal to revise the national ambient air quality standards for particulate matter.

There has been and there continues to be a tremendous amount of conservation activities by farmers and ranchers across this country. These activities include such things as conservation tillage techniques, or so-called "no-till" planting, planting cover crops, planting trees and vegetation for wind breaks. All of these activities reduce wind erosion of the soil which, in turn, provides cleaner air.

Farmers are cleaning the air and should get credit for those activities, but make no mistake that we are all for clean air, and this debate today really is about how to continue to achieve those goals.

Agriculture is concerned because the EPA estimates show that 34.3 percent of the fine particulate matter can be attributed to agriculture and forestry. And, regarding this questionable large estimate, I quote Dr. Calvin Parnell, a professor of agricultural engineering at Texas A&M University, and a member of the Depart-

ment of Agriculture's Task Force on Air Quality. He says—and we agree—"the data used to develop this inventory was based on erroneous emission factors published by EPA for cattle feed yards, for feed mills, grain elevators, and dust from farmers' field operations."

Furthermore, I quote The Honorable Larry Combest, chairman of the House Agriculture Subcommittee on Forestry, Resource Conservation and Research. He says—and we also agree—"The Science employed in developing this rule is not up to par, and I'm concerned that farmers will bear the brunt of a bad policy based on equally bad science. We don't have the research yet to know whether we could actually attain these standards, how much it will cost the agriculture industry and the consuming public, and how much agriculture activities actually contribute to air pollution problems."

Today, however, I want to focus on an actual situation those of us involved in California agriculture already face in regard to the present PM_{10} serious nonattainment area for central and southern California. Agriculture in other areas of the country may face the same situation if new PM standards are imposed. Let me expand on one of our air district's experiences in dealing with the present PM_{10} standards in regard to agriculture.

The emission inventory for agriculture that is used by EPA has proven to have many flaws. Inaccurate estimations of the number of times a farmer drives their tractors over a field is just one major example. It was estimated that farmers tilled an alfalfa field eight times a year. The actuality is that alfalfa fields aren't tilled at all, aren't disked at all. They're cut. There is quite a difference between disking and cutting hay.

It is estimated that rice fields were disked 13 times a year. Rice fields are disked one time a year. Rangeland two times a year. To my knowledge, there isn't any normal practice where you disk rangeland.

But probably the most blatant example of inaccurate inventory which would have cost the agricultural industry hundreds of thousands of dollars was the initial emissions inventory for combustion engines used on irrigation pumps in the San Joaquin Valley. The original inventory estimated that nitrogen oxide emissions, a precursor to PM_{10}, was at 626 tons per day from the irrigation pumps in San Joaquin Valley.

This would have been the highest emission category for any nitrogen oxide in the San Joaquin Valley, including all cars and trucks.

Driven by agricultural inquiries as to this study, a new study was commissioned that was based on actual interviews with farmers about their pumps. The new study determined that nitrous oxide emission for these pumps was actually 32 tons a day, not 626 tons a day.

We have only begun to address agriculture's concern about PM_{10} estimates, many of which are unaddressed and incorrect.

Concerning these discrepancies, it's unbelievable that we are now facing again the same problems, only this time with smaller particulate matter.

In attempting to resolve some of the agricultural emissions surrounding the PM_{10} and $PM_{2.5}$, it became necessary to conduct a

multiyear, multifaceted air quality study. Such a study was developed and is now underway in California. However, it will not be completed, it is estimated, for 5 years.

I want to emphasize that this study is the first comprehensive study that will actually measure, not estimate, PM_{10} emissions. In order to avoid the mistakes that we made with PM_{10}, this study and others like it must be completed before the costly implementation activities and attainment deadlines and regulations are set in place.

In conclusion, I want to emphasize that a shotgun approach will only serve to put American agricultural out of competition with other countries and put agricultural producers out of work.

Because U.S. agricultural commodity prices are really tied to global prices, a farmer cannot simply pass on the cost of doing business to the consumer. Therefore, any increase in operational cost of farming becomes significant and must be based on accurate information that really justifies the expenditures.

We want to be careful that we're not tipping the balance of regulation in this country so far as to force the grocers and the brokers to place their orders with food purchased from other countries.

The agricultural community enjoys breathing clean air as much as anyone, but we don't want to waste money on control measures that will have little or no effect on the air in this Nation.

The USDA must maintain a strong presence and discussion continuing these standards, and we recommend it extend their comments on the issue in regard to economic impacts of the standards on farms and ranches.

USDA, the Small Business Administration, and the USDA's Agricultural Air Quality Task Force must continue to demand that the concerns of American farmers and ranchers are addressed at the EPA in order to sustain a healthy abundant food supply.

Senator INHOFE. Thank you, Mr. Vice.

Mr. Hansen.

STATEMENT OF PAUL HANSEN, EXECUTIVE DIRECTOR, IZAAK WALTON LEAGUE OF AMERICA

Mr. HANSEN. Thank you, Mr. Chairman, Senator Sessions, Senator Baucus. I am Paul Hansen, executive director of the Izaak Walton League of America, which is celebrating its 75th year of working to conserve, maintain, protect, and restore the soil, forests, water, and other natural resources of the United States.

Protection of the Nation's air quality is part of the Izaak Walton League's mission and is of vital importance to our members, the majority of whom live in our Nation's agricultural communities.

We've worked on clean air issues since the first Federal Air Pollution Act, which you may remember was passed during the Eisenhower Administration. You've already heard testimony on a few of the benefits this new standard would realize for the health of our people and our natural environment. I want to implore you today to consider the findings of the Department of Agricultural's national crop loss assessment network data which was released during the Reagan Administration.

We were involved in this NCLAN study and cosponsored a symposium in 1982 with the Boyce Thompson Institute at Cornell University, at which many of the findings were released and discussed.

In 1990 I personally followed up on that information and conducted a literature review of the effects of air pollution on crops, a summary of which is available for you here today.

I'm here today to tell you that there is a great deal of science that shows unequivocally that the benefits of this standard would by far exceed the costs to the American farmer. The new ozone standard would provide millions of dollars in agricultural benefits each year.

At air pollution levels today, well below those that are commonplace, ozone can reduce the yield of commodity crops like corn and soybeans by 10 percent or more, depending on the particular cultivator. Dirty air costs our country approximately one billion bushels of corn and two million bushels of soybeans each year. Based on the 1992 agricultural consensus figures, that cost is approximately $3 billion in lost revenue.

This figure is consistent with the figure found in 1982 by NCLAN, where researchers calculated the air pollution losses alone to only four major crops—corn, wheat, soybeans, and peanuts—amounted to between $1.9 and $4.5 billion annually.

Because these figures did not include other potentially sensitive crops or other pollutants or some of the potentially synergistic effects we heard about earlier, or environmental stresses such as disease and drought, these figures are likely to be much higher than the ones that NCLAN found.

It's very well established in the literature the effects of ozone on crops is very insidious and, in most cases, invisible even to experts such as those we have here today. A 10-percent reduction, which can be common at ozone levels found throughout much of the soybean growing region, while highly significant in terms of yield, would be effectively invisible, even to the trained eye. Can you imagine holding in your hand soybeans, and then another handful of soybeans that would weigh 10 percent less? It would be very hard to see.

In the last 2 years, much more recently, three groups of experts on ozone's vegetative impacts have reconfirmed the seriousness of ozone's impacts on commodity crops, forests, and other vegetation, which were first measured by NCLAN in 1982.

These groups include the agricultural forest and ecological scientists convened at the Southern Occident Study Workshop in 1995, the Department of Interior, and the independent Clean Air Scientific Advisory Committee. All three have recommended a secondary standard for ozone to help protect our Nation's crops and vegetation from the effects of ozone. All have emphasized that crops and vegetation are much more sensitive to ozone impacts than even humans are.

I know that concern has been expressed regarding the cost of implementing a new $PM_{2.5}$ standard, particularly in agricultural areas. I'd like to close by addressing this issue.

First, it's essential that standards be set at levels that are protective of human health, not levels regulated industries consider cost-effective.

More importantly, the new particular matter standard applies to $PM_{2.5}$, not PM_{10}. EPA has not recommended any tightening levels of PM_{10}. The distinction is important because all $PM_{2.5}$ is the product of combustion, and almost all PM_{10} is created by earth-moving activities such as construction, mining, or agricultural practices like tilling.

Third, on most farms the primary source of combustion is diesel-fueled farm equipment. This equipment is responsible for a very tiny amount of the primary pollutants that create $PM_{2.5}$. The amount of these pollutants created by farm equipment is so small that they're insignificant when compared to emissions from other $PM_{2.5}$ sources. It is highly unlikely that they would be regulated under any compliance plan.

Farm equipment also creates only about 1 percent of the national nitrogen oxide emissions and almost no sulphur dioxide emissions.

Finally, the history of pollution control suggests strongly that, even if control on diesel fuel does become necessary, these controls will cost a lot less than predicted.

One industry lobbyist has suggested that our children can stay home on bad air days. Well, farmers don't have that option.

On balance, if you take a good look at the science, I think that you will see that the new standard has a net benefit to the Nation's farmers.

Mr. Chairman, I would like to thank you again for the opportunity to address this new standard's agricultural impacts and to try to shed light on one of the hidden victims of the Nation's polluted air, the American farmer.

I would greatly encourage you to add to the list of people who testify at your hearings some of the Nation's experts, such as Dr. Howard Hack or Dr. Alice Cowling, who have been parts of these committees and were part of the NCLAN study back in 1982.

Thank you.

Senator INHOFE. Thank you, Mr. Hansen.

We had made an attempt to involve as many people as possible, and apparently there is an infinite number of experts out there.

Dr. Fennelly.

STATEMENT OF DR. KEVIN P. FENNELLY, M.D., STAFF PHYSICIAN, DIVISION OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH SCIENCES, NATIONAL JEWISH MEDICAL AND RESEARCH CENTER

Dr. FENNELLY. Thank you, Mr. Chairman and members of the subcommittee. My name is Kevin Fennelly. I'm an academic physician at the National Jewish Medical and Research Center in Denver, Colorado. I'm board certified in pulmonary medicine and in occupational environmental medicine, and my time is evenly divided between patient care and clinical and epidemiologic research.

My research interests include the epidemiology of the health effects of particulate air pollution, so I am familiar with the scientific literature in this area.

I'm testifying today as a concerned physician, scientist, and citizen in support of the EPA proposal for a new particulate matter standard.

I wish to emphasize three points: No. 1, particulate air pollution causes human suffering, not just statistics; No. 2, there is biological plausibility to support the epidemiologic findings of adverse health effects associated with particulate air pollution; and No. 3, the risks of adverse health effects due to particulate air pollution are comparable to other risks which our society has not found acceptable.

I have personally seen patients who report worsening of their asthma symptoms associated with air pollution in Denver, Phoenix, Los Angeles, and the San Francisco Bay area, and colleagues have reported similar encounters to me.

I am disturbed by recent comments which have trivialized the respiratory symptoms associated with air pollution. Allow me to suggest a simple exercise for those of you who may not have experience with respiratory diseases.

Simply take a drinking straw and breathe through it for several minutes. Or, better yet, try to walk about and climb some stairs. Then imagine feeling that way for hours or days. It is not a trivial discomfort.

Another disturbing suggestion I have heard is that patients with lung diseases should simply medicate themselves more to cope with air pollution. This is irrational and violates basic medical principles.

A common criticism of the EPA proposal is that the epidemiologic studies are not supported by biological plausibility. Although we still have much to learn, this is not true. In the killer fog of London in 1952, 60 percent of over 500 autopsies demonstrated both heart and lung disease.

Godleski and colleagues recently presented preliminary findings of an inhalation toxicology study coherent with these pathologic findings. Animals with chronic bronchitis who were exposed to urban air particulates had a much higher death rate than did the unexposed animals.

Other animal studies have demonstrated lung inflammation and injury, especially with exposures to the very small or ultrafine particles.

In my written testimony I have cited several recent papers on the basic biological mechanisms underlying these inflammatory responses.

The critical question is how much risk we, as a society, are willing to accept. In our history, cancer hazards have often been regulated if the risk were greater than 1 per 100,000. In fact, the Clean Air Act amendments of 1990 mandated that the EPA regulate air pollutant emissions to reduce the lifetime cancer risk to less than 1 in 1,000,000.

I suggest that an increased risk of death from heart or lung disease should be assigned equal value to the increased risk of death from cancer.

In my written testimony, I calculated incidence rates for deaths attributable to short-term exposures to particulate air pollution in Denver, Philadelphia, and Los Angeles. For Los Angeles, this risk is 250 per 100,000 persons over 10 years; thus, the risk of acute cardiopulmonary death associated with particulate air pollution

over only one decade is greater than a lifetime risk of cancer previously deemed unacceptable by Congress and the Supreme Court.

Furthermore, acute mortality is only the tip of the iceberg. These estimates do not include the many chronic and nonfatal health effects of particulate air pollution.

These issues are extremely complex, and in our struggles to be objective by analyzing quantitative data it is easy to become known by the numbers. Behind those statistics are real people suffering with real symptoms. There are adequate data to support more stringent regulation of particulate air pollution, and the lack of absolutely certainty cannot be an excuse for inaction.

We could improve the public health by implementing even more protective standards, such as those proposed by the American Lung Association. At minimum, I urge you to support the proposed changes in the particulate air pollution standard as proposed by the Environmental Protection Agency, but with retention of the existing PM_{10} standard.

Thank you for this opportunity to share my concerns.

Senator INHOFE. Thank you, Dr. Fennelly.

Dr. Christopher Grande.

STATEMENT OF DR. CHRISTOPHER M. GRANDE, M.D., EXECUTIVE DIRECTOR, INTERNATIONAL TRAUMA ANESTHESIA AND CRITICAL CARE SOCIETY

Dr. GRANDE. Good afternoon. My name is Dr. Christopher Grande, and I'm a practicing physician from Baltimore, MD. I'm a board-certified anesthesiologist and intensive care specialist in trauma injury. I have authored and edited numerous medical books and have had about 30 articles published in professional journals.

I'm also executive director of the International Trauma Anesthesia and Critical Care Society, or ITACCS for short. ITACCS is a 10-year-old professional association of more than 1,000 trauma specialists and emergency room physicians, nurses, and related professionals.

I also hold a master's degree in public health from Johns Hopkins University School of Public Health.

I would like to thank the committee and Chairman Inhofe for inviting me to provide ITACCS' views on the proposed ozone and particulate matter standards.

Before I specifically address the standards, though, I would like to first give the committee some important background information.

As Dr. Fennelly pointed out, every day I'm in the hospital emergency room I see patients and problems vying for critical resources, from acute asthma patients to traumatic injuries. These are all competing public health priorities—all competing for limited available public health resources.

The focus of ITACCS is traumatic injury, often accidental in nature, such as that caused by motor vehicle, on-the-job, or household accidents. Injury is the leading cause of death for those under the age of 45, and it is the fourth-leading cause of death overall in the United States—about 150,000 deaths per year.

Trauma cuts across all of society. The injured person is not someone else. The injured patient is you, your child, your spouse, your parent.

The average age of injury victims is 20. Death from injury is the leading cause of years per life lost in the United States—more than twice the number of years per life lost as the next-leading cause, cancer, and three times that of heart disease.

According to 1990 statistics from the Centers of Disease Control and Prevention, traumatic injury was responsible for approximately 3.7 million years of potential life lost. In contrast, cancer was responsible for 1.8 million years of potential life lost, and heart disease was responsible for 1.3 million years of life lost.

What does this tell us? The National Academy of Sciences concluded in 1985 that trauma was the No. 1 public health problem in the United States. This situation remains unchanged today.

How is this relevant to the debate over ozone and particulate matter standards? It can be simply put in three words: public health priorities. The fact is that society has limited resources that it can spend on public health. As such, responsible public policy dictates that such resources be spent so as to achieve the biggest bang for the buck.

ITACCS is not convinced, neither should the public be, that the proposed ozone and particulate matter standards are a smart way for us to spend our limited resources. But I want to make it clear that we are not singling out only proposed ozone and particulate matter air quality standards. The proposed standards are merely the latest example in what we see as a disturbing trend over the last two decades where scarce public health resources are diverted from more clearly demonstrated beneficial uses.

The unintended consequence of this diversion might be a decrease in the overall effectiveness and efficiency of public health care delivery.

As the makers of our laws and the ultimate allocators of our public health resources, Congress should take the lead in rationally allocating our limited resources. But how would Congress know what is a priority and what is not? The process behind the proposed ozone and particulate matter air quality standards has not been helpful.

First, the proposed rules do not provide a ranking or comparison between the estimated health effects attributed to ozone and PM and those of other public health needs.

One of the health end points associated with the proposed rules is asthma. No doubt, asthma is a serious issue and our public health resources should be directed at asthma. But a recent study published in the February 1997, issue of "American Journal of Respiratory and Critical Care Medicine," a journal of the American Lung Association, helps place air-pollution-induced asthma in perspective.

In this study, which includes a study design that has been characterized as the most reliable on potential health effects of ambient ozone—that is, the study model of children attending asthma camp—air pollution was associated with a 40 percent increase in asthma exacerbation in children. It sounds bad, but what does this really mean?

Assuming, for sake of argument, that the author's conclusion is reasonable, this increase in asthma exacerbation equates to one extra use of an inhaler amongst one in seven severe asthmatics on the worst pollution day.

However, close scrutiny of this study reveals that many confounding risk factors for asthma exacerbation were not considered by the study authors. These risk factors include: changes in temperature, atmospheric pressure, anxiety, physical exertion, dust, and fumes, and many more—all recognized to be active factors.

Moreover, the study is inconsistent with the general observation that, while asthma has increased over the last 15 or so years, air pollution has decreased.

As stated earlier by the chairman, there appears to be no generally accepted explanation for this phenomenon; therefore, the study does not satisfactorily link ambient ozone with asthma exacerbation.

Before we commit our scarce resources, wouldn't it be useful to know exactly where this very uncertain health effect ranks amongst other real public health priorities?

If asthma qualifies as a public health concern, appropriate levels of funding should be targeted at programs that have been proven to be effective but not fully implemented.

Senator INHOFE. Mr. Grande, we're running out of time. Could you conclude quickly?

Dr. GRANDE. Certainly.

The long and the short of it, Mr. Chairman, to cut to the end of this, is that asthma, as Dr. Fennelly so astutely pointed out, is an important health problem. It needs to be examined within the context of other important health problems. I'm not here to talk about my disease, trauma, today, but if I were, I have the hard statistics to back up any statement that I would want to make that would allow trauma to compete for allocation of other scarce health resources.

Any disease should be qualified as a public health crisis and then appropriate levels of funding should be decided through a competitive analysis based upon sound data.

Senator INHOFE. Thank you, Dr. Grande.

Let me start off with the two gentlemen representing the Farmers Union and the Farm Bureau. We passed a law, the Small Business Regulatory Standards Act, that requires that, prior to putting out a rule, that we deliberate the effects that it would have on what they call "small entities." It's somewhat vague in its interpretation, but generally they're talking about people with less than 10 employees or individuals. I think they're really talking about the farmers of America here.

Apparently, we've heard from these hearings here that this wasn't going to have any noticeable impact. Would you agree with this, that we are—that it's not going to have the impact on what is defined as small entities or firms?

Mr. VICE. I certainly wouldn't agree with that at all. I think it would have a large impact.

Senator INHOFE. There are two areas, two laws that we've talked about several times. That's one of them. The other is the unfunded

mandates. We've heard from the last panel that they expressed themselves pretty clearly on that.

Mr. Vice, you heard testimony from Mr. Hansen. They claim that farms would benefit more from these standards and that the only real cost would be controls on diesel-fueled farm equipment, which he doesn't seem to think will be necessary.

Last week we had a witness from the Southwest Coastal Management District in California—which you probably know that individual. They said that the diesel vehicles would need to be controlled, along with small, two-stroke engines.

How would these controls, in your determination, affect farmers?

Mr. VICE. Well, I think it will affect it greatly. In fact, the latest information I have is that the emissions, alone, is estimated to be—the total emissions, according to a chart that was put out by the Air Resources Board, indicates that almost over a third of all the emissions are from agriculture.

If we start trying to mitigate that, it is going to be a tremendous cost to agriculture. I agree with Mr. Hansen that there would be crop loss. I think there have been studies that would indicate that.

What we do disagree on is how much. In fact, I have a report by EPA's own Scientific Committee reporting on crop loss that says that two of the experts—it said the open-end chambers experiments, by their very design and execution, produces results that over-estimate the effects of ozone on plant yield.

I think that we have a lot of work to be done in this area, and I don't disagree with anyone about the fact that this is a health problem that needs to be addressed.

My testimony and my concern is that we have bad science dictating how much of this is coming from the agricultural community.

When you have a study that says farmers disk a hay field eight times, we know that that's not right.

Senator INHOFE. You're from California, and you, Mr. Junk, are from Pennsylvania, so we're kind of in the middle there out in Oklahoma. I probably speak for Senator Baucus, too.

We have a different type of a problem—that is, a normal wind velocity that is there on a daily basis.

I was in western Oklahoma all day yesterday, all the way from Altus up to Woodward. They are very much concerned about this because on a normal day—in fact, you can't find a day that doesn't have what we feel would put them into the position, as far as the new standards on particulate matter, of being out of compliance.

Would you tell me again—you talked about the faulty information or assumptions that we had on disking of rice fields. I found that to be kind of interesting, although I don't really think about disking of rice fields, but I don't know that you don't disk the rangeland, because we have a lot of that out there. Where did that come from?

Mr. VICE. That was figures that were used in the study on PM_{10} particulate matter, 10 microns, and how much was coming from the agricultural community.

It was estimated that the dust contributed this vast amount, and when they extrapolated back of how the dust ended up in the air it was because of these number of trips through fields that tractors made, and that's where the estimation of 8 times disking a hay

field came up, 13 times on rice, and 2 on rangeland. That was part of the study that was put together on ambient dust.

Senator INHOFE. Yes. And who did this study?

Mr. VICE. It was done, as far as I know, by EPA.

Senator INHOFE. OK. Mr. Hansen, you mentioned that—and I've heard in the last five hearings all kinds of estimates on premature deaths. I think the figure you used was 15,000. The figure that the EPA used at one time—they've used several figures—at one time was 20,000, and then we had a group coming in here that said it was 60,000.

I guess I'd ask you and the two doctors to get a—how do you arrive? You know, obviously someone is wrong, but if you're trying to promote a program that might be a flawed program or a premature program not based on science, the first thing you want to do is get the public thinking that there are thousands and thousands of premature deaths out there.

Give us your estimate as to how they can determine, Dr. Fennelly and Dr. Grande, premature deaths, and why there is such a divergence in these estimates?

Dr. FENNELLY. I'll go ahead.

I believe most of that, or at least the early work, was done by Dr. Joel Schwartz, and it does involve a lot of computations that I think results in some of the disparity in results, because essentially you have to try to get estimates of how much particulate matter pollution there are in various cities across the country, and then for each day try to estimate how much over baseline, if you will, the pollution is, and then what fraction of deaths would be attributable to that.

But, as you said, what I've heard is consistent with your comments, and that is more in the 40,000 to 60,000 per year range.

Senator INHOFE. That's not really what I said. I said that there is a disparity that I don't understand because I don't have that kind of a background.

My beloved mother-in-law died on New Year's Day. She was 94 years old. I've often wondered if she showed up in the statistics.

Dr. FENNELLY. Well, she may if she was in a city where there was high air pollution on that particular day.

Senator INHOFE. Yes.

Dr. FENNELLY. But because of the epidemiologic nature you can't isolate any one person.

Senator INHOFE. Dr. Grande, any thoughts on that?

Dr. GRANDE. I agree with a lot of the way that Dr. Fennelly has explained the process of collecting the data. On a specific point, the number that you brought up, I heard the 15,000 to 20,000. Let me point out that I am not an expert on ozone or air quality standards, but I do have training and background in public health and biostatistics, and, as far as that 15,000 or 20,000 deaths per year disparity, it was my understanding, as acknowledged recently by the EPA and then reported in major newspapers such as The Washington Post, the simple error of using an arithmetic mean instead of using an arithmetic median reduced this estimate mortality from fine particulate matters down from 20,000 to 15,000.

Now, having reviewed, as I have, a fair amount of the data and literature, both from the physical sciences side of this as well as

the clinical science side of it, and as an educated observer, it seems to me that the right hand is not talking to the left hand about this data, and that's one of the problems. A lot of this clinical studies which really would represent, if you will, where the rubber meets the road have yet to be done.

But, in general, reviewing the collection of data that I've seen on this—and I've heard people much more educated and astute about this comment the same, which is that it's an extremely poor collection of data. It's based on a number of assumptions which, if—it's almost like a house of cards. If you pull out one card, everything through that entire assumption could fall apart.

Senator INHOFE. I understand.

Senator Baucus.

Senator BAUCUS. Thank you, Mr. Chairman.

Gentlemen, obviously the goal here, as in most hearings, is to find the truth. Usually there is a grain of truth in what everybody says, and it's usually true that people kind of take their own positions in representing their own organizations, which tend to be a little more extreme than the middle. That's not always the case, but I think it's a fair assumption.

So I'm going to take that assumption and assume that each of you is taking a position which is tilted a little bit more toward your organization's usual point of view rather than where the real truth actually lies here—that is, somewhere in between—and attempt to try to find that.

Now, there are some who say that even though PM_{10} is an issue with respect to wind and dust and so forth, that what we're really getting at here is not PM_{10} at all but $PM_{2.5}$. And those people say—and this is EPA's data. Right away that's going to raise a red flag. Some people are going to say, "It's EPA, therefore it's wrong," but I'm going to assume that it's accurate until it's proven wrong.

According to EPA, wind-blown dust is really only a small part of $PM_{2.5}$—in fact, it's about 10 percent of $PM_{2.5}$—and that farm activities are responsible for about one-third of wind-blown dust, and therefore a calculation is that farm activities are responsible for only about 2 to 3 percent of the total $PM_{2.5}$ problem, and that's somewhere along the lines of what you were saying, Mr. Hansen, if I heard your testimony correctly.

And the rest of $PM_{2.5}$, comes from combustion, and farm activities obviously through diesel combustion are part of that.

But its this analysis that I am referring to—again this is off of the EPA web page—that essentially, with respect to $PM_{2.5}$, farm activities are about 2 to 3 percent of the problem, and with respect to that part—and if we're to even look at diesel fuel and combustion, which would be diesel combustion, that when a State implements a plan, a State has all kinds of options on how to implement a plan.

Perhaps a State might want to say, with respect to diesel combustion on farms, that that's not going to be touched; that, rather, they might look at diesel fuel off coast with ships or highways, or trucks—diesel combustion from trucks, for example.

I know that farmers have a pretty good lobby, and my sense is that farmers will do a pretty good job in not being part of the problem.

So what I'm really trying to get at here is first you, Mr. Hansen, and I'll ask you, Mr. Vice, to comment just on that general proposition that if you really look at the actual data that farm activities are really a very small part of 2.5, and then the next point is with respect to what we do about that if this proposed regulation were to go into effect, that it is true that there are lots of ways to deal with that, and one is through the State implementation plan, and when the States do devise their implementation plans there are a myriad number of ways that they can deal with the combustion part of it.

So, Mr. Hansen, your observations? You know, we're all Americans. We're here together. We're just trying to find a common solution here.

Mr. HANSEN. Thank you. Mr. Chairman, Senator Baucus, I think you're absolutely correct that State implementation plans are very unlikely to include farm equipment and that $PM_{2.5}$ is really not going to be affected by agricultural activity to any great extent.

Diesel engines are already regulated by EPA and will continue to be. And we should point out that EPA has expressed their willingness to collect $PM_{2.5}$ monitoring data for 3 years before $PM_{2.5}$ implementation, so we should know a great deal more about this very question before anything before the States would be asked.

Senator BAUCUS. So what you're saying is if this were to go into effect it would be about 10 years before it's felt?

Mr. HANSEN. Very likely.

Senator BAUCUS. And lots of different options and alternatives during that 10 years to try to figure out an answer to this.

Mr. Vice.

Mr. VICE. Thank you, Senator Baucus. I couldn't agree more with you that we—this is an issue that, as we like to say, the science is in the following mode as to some of the regulations that are being proposed.

For example, we started 2 years ago with the reformulated diesel in California during the winter months. We today do not know how much good effect or bad effect that's having. We think it's good, but, quite frankly, we don't have the figures in from that yet.

There is a study that's being implemented right now, a good, hard study that measures what is the emissions out of farm equipment diesel and trucks hauling on the highway products with the reformulated diesel in the winter months. We don't have those figures yet.

What we're saying is, "Let's don't rush to implement standards where we don't have the hard evidence." We have estimates on what the emissions really are. Give us a chance to find out what those hard numbers are so we can make intelligent decisions rather than just rush into something.

Senator BAUCUS. Yes.

Mr. VICE. And I appreciate your estimate of the farm lobby, but I would maintain that anybody that sees over one-third of the emissions coming from agriculture isn't going to want to leave agriculture out of the formula to try to fix it.

Senator BAUCUS. But we've determined it's not one-third; it's about 2 to 3 percent.

Mr. VICE. Well, according to EPA's figure it's 34.5 percent is agriculture and forestry.

Senator BAUCUS. Not with respect to $PM_{2.5}$.

Mr. VICE. This is the $PM_{2.5}$ pie chart.

Senator BAUCUS. Well, I have different EPA data. What I have is, once you calculate it out, it's about 2.5 from PM_{10}—from $PM_{2.5}$.

Mr. Vice, I'm just curious—Mr. Chairman, one more question?

Senator INHOFE. Sure.

Senator BAUCUS. I was just struck with Mr. Hansen's point that the ozone standards will actually increase crop yields. Do you agree with that or not? As I understand, it's USDA data. I don't know where you got that information.

Mr. VICE. I think there's crop damage. I don't agree that it's anywhere to the extent that Mr. Hansen has indicated. We think there are some—we know that there are some decrease.

I was pointing to the EPA's Scientific Committee on that subject, where they admit in their own information that the figures that fall in their report are highly over-estimated. That's their Scientific Committee's report.

Senator BAUCUS. Have you seen that, Mr. Hansen, that document that Mr. Vice is referring to, where apparently there is some acknowledgement that the data is over-stated?

Mr. HANSEN. I've not seen this. I do have data from USDA, 1984, which has a list of the reductions for various cultivars. I'd be glad to submit this for your consideration.

Senator BAUCUS. Mr. Chairman, if we could just have both documents submitted for the record, we could go through it and try to determine what's going on here.

Mr. HANSEN. The numbers are very high for some cultivators.

Senator BAUCUS. Thank you.

Thank you, Mr. Chairman.

Senator INHOFE. Senator Sessions.

Senator SESSIONS. Thank you very much, Mr. Chairman.

I think we do have a serious public policy decision to make.

Dr. Grande, I want to express my appreciation to you for your remarks. As somebody who just joined this committee, just joined this body, I came in here and would ask certain questions like, "If we're going to deal with asthma and the ozone levels cost $6 billion to implement, could we save more asthmatics by spending $6 billion more on treatment and care of asthmatics?" And I'm told, "Oh, no, you can't ask that question. That deals with cost, and we're not here to talk about cost." But obviously we're here to talk about cost.

You had the courage to come in and say some things I thought were very, very worthwhile.

Let me ask you this: is it your understanding on the 15,000 premature deaths that many of those would represent terminally ill patients that are in very weakened positions? Would that be factored into the numbers?

Dr. GRANDE. I think my understanding of the terminology or the phrase used is premature deaths in the context of this discussion on ozone and air quality and PM. There are a lot of what we would call "confounding factors," and particularly if you look at the mean age of these so-called "premature deaths." They tend to be skewed

toward the older age groups, and they seem to show that there is an association with some other underlying cardiopulmonary diseases. And whether Mr. X was going to die on Tuesday from whatever it was that killed him versus on Wednesday, and whether air quality had anything to do with that or not I think is a very difficult issue to prove.

It would be nice if we could prove it, but I don't think there have really been any legitimate efforts to try to prove that.

As far as the comment that you made in terms of whether we can more intelligently or effectively or efficiently spend the money that we are going to spend for asthma, which is a public health problem, I think Dr. Fennelly, as a pulmonologist, sees far more patients with chronic asthma than I do. I see patients with acute asthma that come into the emergency department or the ICU.

Yes, it's true that it's a very dramatic presentation of somebody gasping for their next breath, but I have to also tell you that, as somebody working in those environments, the medications that I have available to me now allow me to rapidly and effectively reverse that "death's door" situation, whereas the same patient, same age, comes through the door after having been in a car accident with a head injury and I can't do anything about that.

So if you wanted to ask me if that next patient coming through the door was a relative of mine and where am I going to spend my next dollar, I would have to say on something else. Or, if you wanted me to spend it on that, you've got a much larger job to prove it to me that that's an effective allocation.

Senator SESSIONS. Well, it is a very troubling moral dilemma for us to wrestle with, and I think, with regard to trauma deaths, as you point out, many of those are otherwise healthy with long life expectancies.

I think that's something that, as we consider—and I think it's important to understand, and I think most of us do that are thoughtful, that any burden that we place on local government, farmers, industry, or individuals that's a cost is the equivalent of the Federal Government taxing them and doing that for them.

In other words, it is a drain on their resources, and before we do that we ought to ask, if we're going to drain that resource, where would we spend it to get the most benefit for the most people.

One of the things that's troubling me has been the numbers. I do find that strange. Mr. Chairman, you pointed out the cost/benefit study error that is very significant, I think, very troubling that EPA would miss that, and then we have them cultivating hay fields 8 times or 13 times a year. Anybody that knows anything about—I mean, that's out of the range. That's not an error. I mean, that's just dreamland numbers. If you know about farming, you know that's not true.

So I don't know where we are on all those things, but they are matters that concern me.

Dr. Fennelly, do you know how the premature death numbers are calculated? Do you know? Can you tell us, in your best judgment, because it still concerns me that 15,000 may be prematurely dying. I think that's a very significant figure. I don't mean to minimize it, but how is that calculated?

Dr. FENNELLY. Well, these are difficult epidemiologic methods. They generally are based on time series studies where you add in all the variables that you know about that contribute to a health outcome—in this case mortality—and, for example, we know that season, temperature, humidity, day of the week, a number of factors are involved, and so you create a base model and say that this is the variability that we would see.

Senator SESSIONS. Day of the week?

Dr. FENNELLY. Day of the week. Monday mornings are a very bad time, just so you know.

Senator SESSIONS. Police say the full moon is a bad time.

Dr. FENNELLY. Not that we know of. And then on top of that you add the air pollution variable, or whatever exposure you're interested in, to see if there's an excess in that amount.

Part of the problem now is that—and the reason the science has come to the forefront is because of the great computing power that we have now and the improvement in statistical methods. In a way, this is—I sort of feel like people are shooting the messengers when they get mad at the epidemiologist for coming up with these studies, because these are very sensitive tools.

It's the same as going into your doctor feeling fine and then having your doctor say your blood pressure is elevated and you need to take this, and you say, "I didn't perceive a problem. What's the deal?" In a sense, on a population basis, I guess that's the best type of corollary I can offer.

The problem is these are very small effects, I'll grant you that, but they're distributed through a large number of people across the country.

You'll probably remember in 1984 the Bhopal disaster. More than 2,000 people were killed in that disaster due to an acute release of methyl isocyanate. But in a way we have become numb by the numbers because we're talking about, "Well, is it 40,000 or 60,000?" Just as an aside, I think the 15,000 we're talking about are the amount of lives saved. The 40,000 to 60,000 are the total mortality attributed to particulate air pollution. Either way, it's a lot more than 2,000.

And so in a sense we have to deal with our improved technology, our improved ability to detect these very subtle effects.

I'll grant you, these are very difficult decisions to make based on public health priorities and all the priorities that you face.

Senator SESSIONS. Not only that, but the question is, If somebody had severe emphysema and would be adjudged to be terminally ill, if they died when there was a bad ozone or particulate day, that would be part of the statistics number; is that right? And so it is fair to say if more died on a bad air, during bad pollution, that is an adverse health effect.

Dr. FENNELLY. Yes.

Senator SESSIONS. But we're talking about that kind of effect, aren't we?

Dr. FENNELLY. Yes.

Senator SESSIONS. Premature death? Is that the right phrase?

Dr. FENNELLY. We're looking at the excess of total deaths on those particular days.

Senator SESSIONS. Excess of total deaths on the days in which the pollution is bad?

Dr. FENNELLY. Right, compared with lesser pollution.

Senator SESSIONS. Thank you.

Senator INHOFE. Thank you, Senator Sessions.

I want to thank the panel very much. You will be receiving some questions in writing.

Yes, Mr. Junk?

Mr. JUNK. I apologize. I'd like to make a comment to your first question that you asked earlier about the small business impact.

Senator INHOFE. Yes.

Mr. JUNK. I think it's important that we take a look at that issue because of the fact that I don't believe that it has been recognized within the agricultural community of what impact this will have on the small family farm operations.

USDA has stated concerns held by farm groups that the new standards may impose significant cost on farmers, particularly the 71 percent of U.S. farms with annual sales of less than $40,000. That's a large segment of agriculture that's going to be impacted dramatically by these standards, especially when we look at not just the tractor that is driven on that farm, but the inputs that they have to purchase off the farm such as fertilizer, such as pesticides, such as other associated products used to produce that crop, along with the livestock operations as far as the emissions from the livestock operations, also.

How does that affect the poultry farm, the dairy farm, the beef farmer? Those are critical issues that need to be addressed and need to be addressed on economic impact to the whole industry.

Senator INHOFE. I appreciate that, Mr. Junk, and I think also the fact that if you're talking about small entities you're talking about, whatever definition you use, the impact on utility rates is going to be about an increase of 8 percent, as we have determined that it's in that range, anyway. That affects everybody.

Our time has expired for this panel. I appreciate very much your being here. I know your time is very valuable. You will be receiving some questions in writing.

Mr. VICE. Mr. Chairman, could I leave two documents for the record?

Senator INHOFE. Yes.

Mr. VICE. The letter that was in question, the amount of crop loss. That's EPA's own scientific panel. Plus the pie chart on 2.5 that Senator Baucus was concerned about that shows that they believe it's 29. I'd like to submit both of those for the record.

Senator INHOFE. Yes. Without objection that will be made a part of the record.

I'd invite our third and final panel to come forward to the witness table. I'd like to welcome Mr. Harry Alford, who is the president of the National Black Chamber of Commerce; Mr. Frank Herhold, executive director of the Marine Industries Association of South Florida; Mr. Jeffrey Smith, executive director of the Institute of Clean Air Companies; and Mr. Glenn Heilman, vice president, Heilman Pavement Specialties, Incorporated, for the National Federation of Independent Business.

We will start with Mr. Alford.

STATEMENT OF HARRY C. ALFORD, PRESIDENT AND CEO, NATIONAL BLACK CHAMBER OF COMMERCE

Mr. ALFORD. Good afternoon, Mr. Chairman.

As you know, my name is Harry Alford, president and CEO of the National Black Chamber of Commerce. The NBCC is made up of 155 affiliated chapters located in 43 States. We have three divisions, nine regions, 43 district offices. We have them in Tulsa, Oklahoma City, and Lawton, for your information, Mr. Chairman.

Through direct membership and by our affiliated chapters, the NBCC directly speaks on behalf of 60,000 black-owned businesses and represents a total populous of black-owned firms which, according to U.S. Census, is over 620,000.

The NBCC is opposed to the two proposals presented by the EPA that would set a more stringent ozone standard and establish a new standard for emissions at or below $PM_{2.5}$.

The Clean Air Act of 1990 has made much progress in improving our environment. We sincerely feel that the continuance of this process will further improve the environment. To put more stringent demands on our businesses will have extreme adverse impact on business, in general, with even higher stakes for small businesses, per se. If big business gets a cold, small business gets the flu, and black-owned businesses suffer pneumonia.

An example of the above can be found in our campaign to develop business partnerships with the automobile industry. We have approached and are working with principals within the management of Ford, Chrysler, and General Motors. One success story is at the time of preliminary discussions with Chrysler we had no black-owned architect, civil engineer, or construction company performing work of over $1 million. Today, after just 1 year of interaction, we have businesses in such disciplines actively working on or negotiating over $100 million worth of Chrysler expansion.

This is just one example. These three auto makers have expansion plans in cities located in the midwest, southwest, southeast, and northeast. This is an expansion investment of $37.9 billion, which is the equivalent of the total annual sales for all black-owned businesses combined.

Just competing for this business and winning 10 percent would increase the total output of America's black-owned businesses by over 10 percent. It's a goal worth going after; however, it may not exist for the black segment of this economy if the new standards go into effect. This is just the auto industry. We're busy creating alliances with the oil industry, electrical utilities, telecommunication companies, etc.

The potential for economic parity and true capitalism in black communities, the missing link is before us. Viable employment through economic infrastructure in currently distressed neighborhoods is going to be the answer to improved health care, education, family values, and the decrease in hopelessness, crime, welfare, and violence. There is just no other way to do it.

We've heard coming out of EPA terms such as "environmental justice" and "environmental racism." Such terms are not accurate in their description. They imply that the evils of big business conspire in back rooms to wreak havoc on minority communities by dumping toxic and hazardous materials, etc. The coincidence of en-

vironmental hazards in minority communities is a matter of economics. Property values and shifts in desirable business properties are the main reasons. Minority populations just happen to live there after a cycled geographical shift in these communities.

However, if there was ever a policy or proposed regulation that could be considered directly adversarial to a particular segment of our population, we may now have it. The proposed standards are going to hit urban communities the hardest. Of the 620,000 black-owned businesses, at least 98 percent of them are located in urban areas. Hispanic and Asian businesses probably can claim the same.

As mentioned above, black-owned businesses are presently at the end of the business food chain. If business suffers, black businesses will suffer the most. The main vehicle for black community development is business startup and growth. The proposed standards will become predatory to black-owned businesses in all black communities, and we must vehemently protest them.

The NBCC has been quite successful since its inception in 1993. We have black church organizations, educators, political leaders, and traditional civil rights organizations talking about economics, the lack thereof, like never before. Corporate America has been waiting on black communities to focus on the principles of capitalism, which is the blood line for our future security.

The time is before us, and I foresee a rapid change to economic empowerment for communities that have suffered for too long. The EPA's attitude and proposals are counter to this trend and thus pose the biggest threat.

The increased cost that will pain the Fortune 500 and maim small businesses will obliterate minority businesses, especially black-owned businesses. The end result is lost jobs and the lack of capital infusion.

I personally lived in Detroit and Chicago during economic downturns. What was experienced by dwellers of these urban communities and others was not a pretty sight at all. Shame on us if we allow this to happen once again because we quickly moved to make the earth pristine in a fashion that will surely hurt our economic infrastructure.

Let us work in harmony toward making the environment as safe as possible without making those who have the least resources pay the most.

The National Black Chamber of Commerce pleads with Congress to strongly consider the ills of the proposed standards and encourage EPA to be more thoughtful and universal in its approach.

Thank you, sir.

Senator INHOFE. Thank you, Mr. Alford.

Mr. Herhold.

STATEMENT OF FRANK F. HERHOLD, EXECUTIVE DIRECTOR, MARINE INDUSTRIES ASSOCIATION OF SOUTH FLORIDA, FOR NATIONAL MARINE MANUFACTURERS ASSOCIATION

Mr. HERHOLD. Chairman Inhofe and subcommittee staff, good afternoon. My name is Frank Herhold. I'm the executive director for the Marine Industries Association of South Florida, which represents over 700 marine businesses. I'm also here on behalf of the National Marine Manufacturers Association, which is the national

trade association representing over 1,500 boat builders, marine engine, and marine accessory manufacturers.

I'm here today to explain why the EPA's proposed revisions to the national ambient air quality standards will be bad for recreational boating. What is bad for recreational boating is bad for the State of Florida and the Nation.

There are currently 750,000 registered boats in the State of Florida, and the latest annual marine retail sales figures topped $11 billion in Florida.

To put this into perspective, my home county, Broward County, alone, the marine industry represents a total economic output of $4.3 billion, employs almost 90,000 people, and has an average growth rate of 6.5 percent. Boating brings dollars and jobs to the State of Florida.

The Clean Air Act amendments of 1990 have placed a significant technical and economic challenge on the recreational boating industry. The new marine engine regulation, marine engine emission regulation, which was finalized in July 1996, will require that all new marine engines reduce hydrocarbon emissions by 75 percent. Economic impact estimates have this regulation costing the industry over $350 million, increasing the cost per boat engine by as much as 15 percent. Regardless, we have made the commitment to bring forth a new generation of marine engines featuring cleaner technology.

Additionally, the Clean Air Act will also regulate air emissions from boat manufacturing plants, with a maximum achievable controlled technology standard scheduled to be promulgated in the year 2000. This regulation will also be very costly, raising the cost of boats, thus directly reducing the number of people who can afford to enjoy boating.

Needless to say, the proposed revised national ambient air quality standards will have a devastating effect on the recreational marine industry. Without drastically re-engineering American society, States will be forced to press emission sources for further reductions, many of which, like the recreational boating industry, have reached the point of diminishing returns.

A couple of years ago, when the national ambient air quality standard for ozone was initially set at .12 parts per million, some State regulators in nonattainment areas considered bans on recreational boating as a method to meet the requirements of their State implementation plans.

The Washington, DC, Council of Governments, COG, actually proposed a ban on recreational boating right here in Washington in 1993. This proposal raised immediate opposition from boaters, marinas, marine retailers, waterfront restaurants, and other affected groups.

COG eventually reversed its decision after the affected parties spent considerable resources to educate COG as to the proposal's adverse effects.

This EPA proposed revised standard will again force States to reconsider such episodic bans, and this time States may be pushed to implement episodic restrictions on recreational boating throughout the Nation.

I'm appealing to you to stop EPA's attempts to revise the standards at this time. It is my understanding that the scientific studies the EPA is using to defend this proposal do not take into account either the specific constraints in air pollution or the mitigating factors that affect human health.

I feel that EPA would be premature to impose such a burdensome standard without first identifying the specific benefit and real cost of the proposal. We've been hearing this element throughout the discussions this afternoon.

Even if we fail to convince EPA that it is making a horrible mistake, at a minimum let us somehow prevent States from using episodic bans as a means to obtain compliance. Episodic bans will negatively affect a person's decision to first of all purchase a boat, knowing that on the hottest days of the summer our government can take away his or her freedom to operate it. Not since Congress passed the luxury tax have boaters faced, in our opinion, a more serious threat.

If this standard is finalized in its current proposed form, consider the burden it will place on States, our marine industry and its workers, and the millions of people who just simply want to spend a summer afternoon on the water with their family.

In south Florida we have a saying, "Boating is the lifestyle of south Florida." In fact, it was on the cover of the Southern Bell phone book 2 years ago. It really is a lifestyle.

In conclusion, everybody needs to realize that America's air is cleaner and will continue to improve as the benefits from recently and soon-to-be-initiated Clean Air Act regulations are realized.

What we do not need now is more regulation. What we do need now is the time and resources to implement those regulations that are already on the books.

Boaters want clean air and clean water, and the recreational marine industry is ready to assist both Congress and EPA in this rulemaking process.

Thank you very much for the opportunity to testify.

Senator INHOFE. Thank you, Mr. Herhold.

Mr. Smith.

STATEMENT OF JEFFREY C. SMITH, EXECUTIVE DIRECTOR, INSTITUTE OF CLEAN AIR COMPANIES

Mr. SMITH. Thank you, and good afternoon, Mr. Chairman.

I am Jeff Smith of the Institute of Clean Air Companies, which is a national association of companies that supply air pollution control technology for stationary sources that emit all of the pollutants that contribute to PM and ozone.

This afternoon I will briefly note the impact of the proposed standards on our industry and offer a few thoughts, as well, on the overall cost of the proposal.

Suppliers of control technology for the pollutants that would be affected by the EPA proposal are, themselves, mostly small businesses. We employ tens of thousands of people, and these firms, in general, have suffered disappointing earnings recently, which have necessitated severe downsizing and, in many cases, job losses.

The EPA proposal would benefit these businesses at an important time; thus, resolving the admittedly tough clean air issues we

face in a way that protects public health and the environment has an important side benefit: it would also promote the air pollution control industry, which creates jobs as compliance dollars are recycled in the economy.

This industry is currently generating a modest trade surplus, which does its part to help offset the billions of dollars this Nation is currently hemorrhaging each month on international trade, and is providing technological leadership that can continue to be deployed in the fast-growing overseas markets for U.S. air pollution control technology.

Now, no one, of course, knows what the overall cost of the proposal would be, but I do think that it's well to remember several of the lessons that we've learned in the last 27 years in implementing the Clean Air Act, and one of these is illustrated, oddly enough, by my experience nearly a decade ago when I sat before various House and Senate committees and presented detailed implementation cost estimates for the acid rain provisions of what later became the Clean Air Act amendments of 1990.

At that time, regulated industry claimed the removal cost of SO_2, which is the leading precursor to acid rain, as well as the leading precursor to fine PM, would reach thousands of dollars a ton, while EPA claimed a more modest sum of $1,500 to $2,000 a ton was about what we could expect.

I disagreed at the time, arguing that market and technical data supported a dollar-per-ton remove cost of about $500, but I was wrong, too. We overestimated the cost, as well, because today, in 1997's inflated dollars, a ton of SO_2 can be removed for about $110 a ton.

The preeminent lesson, we feel, in our Nation's 27-year history under the Clean Air Act is that actual compliance costs turn out to be much lower than the costs predicted at the outset of a regulatory action. Why? I believe the answer is because regulated industry, markets, even the technology suppliers turned out to be a lot smarter than forecasters like myself could give them credit for being at the outset of a regulatory action.

I think this is going to be even more true in light of today's emphasis on flexibility, market-based compliance, and pollution prevention.

Those who would predict gargantuan cost impacts for EPA's proposal I think ignore this important lesson and also under-estimate the wisdom of State and local officials who, after all, will be on the front lines implementing these standards.

Everyone has an interest in rational, prudent, cost-effective clean air policy, and the cost-effectiveness of various compliance options will be considered during implementation, and there is no reason not to believe that, as has always been the case, all of us—regulated industry, government officials, technology suppliers—will discover ever-more cost-effective compliance solutions, especially since nearly a decade exists between now and when the impact of the standards would be felt.

For our part, members of the Institute, the air pollution control technology industry, continue to invest in our research and development to improve removal efficiencies while lowering costs and simplifying operation. We have to. The air pollution control tech-

nology is innovative and highly competitive, and improvements in cost-effectiveness are what give business or technology a competitive edge over another. In this respect it's a little bit like the personal computer industry.

In closing, the Institute expresses its appreciation to you, Mr. Chairman, and the subcommittee for providing a forum for dialog on this important issue and for letting this industry participate in this hearing.

If EPA's proposal to revise the PM and ozone health-based standards goes forward, the U.S. air pollution control industry is ready to do its part to help our Nation achieve its goals cost-effectively.

Based on historical precedent, the current pace of control technology innovation, the use of market-based incentives, the years between now and the compliance deadlines, and competition within the air pollution control technology industry and among technologies, we are confident that the actual cost of compliance will be less than most of us today imagine.

Again, thank you very much, sir.

Senator INHOFE. Thank you, Mr. Smith.

Mr. Heilman.

STATEMENT OF GLENN HEILMAN, VICE PRESIDENT, HEILMAN PAVEMENT SPECIALTIES, INC., FOR NATIONAL FEDERATION OF INDEPENDENT BUSINESS

Mr. HEILMAN. Thank you, Mr. Chairman, and good afternoon.

My name is Glenn Heilman, and I'm a vice president of Heilman Pavement Specialties, Incorporated, which is a small, family-owned business that has been in operation for 41 years. We are located in Freeport, PA, which is just above Pittsburgh.

Thank you for giving me the opportunity to testify on behalf of the National Federation of Independent Business regarding the recently proposed national air quality standards for ozone and particulate matter.

In addition to being a small business owner, I also volunteer and serve as chairman of Pennsylvania's Small Business Compliance Advisory Panel. This panel is mandated by section 507 of the Clean Air Act amendments to help small businesses as part of the Small Business Stationary Technical and Environmental Compliance Assistance Program.

This program has been enormously successful, despite underfunding, and has become a model for small business programs and other environmental legislation.

Our small business program conducts seminars, offers a toll-free confidential hotline, low interest loans, and many other outreach efforts for small businesses. Every State has such a program in varying degrees of effectiveness. These programs are valuable tools to improve our air quality and are overseen by the Environmental Protection Agency.

In my position as chairman, I am keenly aware of the progress we're making in cleaning our air. What appears to be ignored is that our air quality has improved significantly since the passage of the Clean Air Act, and the 1990 amendments have not even been fully implemented.

It is, therefore, imperative that only requirements that are essential be mandated. What I suggest is that we move toward more complete compliance with existing standards before revising them.

As a small business owner, the economic impact and burdensome regulations of the proposed standards would significantly affect and threaten the livelihood of my business. As a manufacturer of road pavement, my business operates asphalt plants and hauls stone as raw material. The moving of equipment and material creates minor particulate matter.

I also have air emissions from my heavy truck and off-highway equipment. Some of this equipment is old but works well, and I simply could not afford to buy new equipment to comply with the proposed regulations.

As a small business owner, I'm active and involved because I have to be. Careless regulations will put me out of business. Not only will small business owners lose life savings and investment, but our employees lose their jobs and our communities suffer economically. For that reason, I am shocked and I'm disappointed that the EPA has declined to consider the effect of this proposed rule on small business.

Last year Congress passed and the President signed a law that requires the EPA to assess the impact of regulations on small business. To date, the EPA has refused to do this on the ozone and particulate matter study. Because this regulation is likely to have a great impact on a variety of small businesses, I hope that the EPA will carefully consider the consequences before they impose this new standard.

Rather than implementing new regulations for clean air, I recommend utilizing and encouraging the use of present means to achieve air quality improvements. There are technologies presently available to help clean our air. In our company, we voluntarily look for ways to improve the environment.

In 1980, my father developed a new ozone-friendly technology for asphalt roads. This technology is exemplified in a material called "HEI-way General Purpose Material" or HGP. A 2-year university study documents that HGP emits seven times less VOC—Volatile Organic Compounds—in the form of low molecular weight normal and branched alkane hydrocarbons than the present technology used to pave roads.

Additionally, this technology also eliminates a significant water pollution threat to rural streams and wetlands.

Under standard technology, present road paving materials allow more than 1,000 gallons, or three tons of gasoline-type VOC to evaporate into our troposphere for every mile paved. HGP reduces this VOC air pollution by 85 percent.

On a nationwide basis, of the nearly four million miles of roads in the country, this technology is applicable to over 60 percent of them. In Pennsylvania, alone, if just 1 percent of the roads were paved each year with HGP instead of the standard technology, over 3,000 tons of VOC air pollution would be eliminated.

The HGP technology could be more widely used to lower VOC air emissions as soon as EPA allows for discreet emission reduction credits under the new source review.

In closing, it is important to keep in mind the unique nature of a small business owner when examining our reaction to environmental legislation and regulation. Small business owners wear many hats. Two of the most important are being both a business owner and a citizen of the community. We drink the water, we breathe the air, we fish the lakes. We want to help the environment for ourselves and our children; however, we also expect the Government to be fair and responsible.

The new regulations as proposed by EPA for ozone and particulate matter are unnecessary and they will result in an enormous regulatory burden and threaten a business that my family has spent 41 years to build.

A viable framework is in place. It consists of new, environmentally friendly technologies such as HGP, and couples these initiatives with existing programs. The system is working. Let's use what we have.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you.

Mr. Heilman, let me kind of start with you here. Your comments are both as a small businessman and representative of the position of the NFIB; is that correct?

Mr. HEILMAN. Yes, it is, sir.

Senator INHOFE. And the NFIB I know is—I had an occasion to talk to some of their staff here in Washington. They're very much concerned about it.

I'd just like for the record, since I'm very much concerned about the Small Business Review Act—I was involved in that when we passed it, and the whole idea was to be able to quantify the effect on small businesses before we promulgate or propose rule changes. I would assume, from your statement, that you don't believe that they complied with that act?

Mr. HEILMAN. No, I don't believe that they have done any of the regulatory flexibility act analysis. Furthermore, no small business review panels, as I understand, are to be conducted. They have not been done.

In doing so they, in my opinion, dropped the ball. Let me tell you that in my business, as far as looking at the cost in retrofitting our diesel trucks and putting in some dust control at $15,000 a truck for our small business at seven trucks, that's over $100,000, and our dust control would be over $20,000. That would be very prohibitive for us to go out and hire new people at those costs.

Senator INHOFE. I think you've also taken the position that if we continue just under the standards there today and the efforts that people are making on both a voluntary and a mandatory basis, that the air is getting cleaner.

Mr. HEILMAN. No question. We have a long way to go with these compliance advisory panels that each State has.

Senator INHOFE. Mr. Alford, I heard you say that 98 percent of the businesses, but I didn't get the number of businesses you were talking about.

Mr. ALFORD. It's 620,000 black-owned businesses per the U.S. Bureau of Census for 1992, and of that, if we look at the industry, 98 percent of that 620,000 are in urban areas.

Senator INHOFE. Did it also say about how many people that affects? I mean, did it have an average size of those 620,000 businesses?

Mr. ALFORD. Yes. The mean, sir, would be 32.5 billion divided by that 620,000.

Senator INHOFE. All right.

Mr. ALFORD. I've got my calculator.

Senator INHOFE. That's a job for the staff. I'm sure they've already got that done.

You also mentioned the environmental justice program. This does bother me a little bit. Do you know whether Agency has actually looked at the impacts in regard to the environmental justice, that term we used?

Mr. ALFORD. We had a meeting. The Hispanic Chamber of Commerce had representatives, the National Indian Business Association, and the National Black Chamber met with Administrator Browner. And when I brought up the term "environmental justice," truthfully she just became very condescending, almost indignant, I guess, to where black businesses fit in this picture and started talking about jobs that had been created through her efforts of brownfields.

I asked for that documentation, and that was about 2 months ago, and I still haven't received it.

Senator INHOFE. You said there were two other groups?

Mr. ALFORD. The Hispanic Chamber of Commerce, which represents the Hispanic business community——

Senator INHOFE. And the other one?

Mr. ALFORD [continuing]. And the National Indian Business Association.

Senator INHOFE. OK. Do they share your sentiments, and would they endorse your testimony today?

Mr. ALFORD. Absolutely.

Senator INHOFE. OK.

Mr. ALFORD. Absolutely.

Senator INHOFE. I know you don't have information there, but for the record I would like to know what the statistics show that membership—the number of companies that would be involved there, too.

Mr. ALFORD. Sure. Hispanic businesses—I'd better look it up and provide it to you.

Senator INHOFE. You can get that for the record at a later time.

Let me just ask you this. What do you think would have the greatest impact on health—economic development and jobs or these standards?

Mr. ALFORD. If you've got money you can provide insurance and good health care for your families. You can also send your kids to school.

Senator INHOFE. Well, I appreciate it very much. You've brought a different perspective that I was not aware of.

Mr. Herhold, you talk about your position is that the national ambient air quality standards should not be revised. Is the basis of your argument that the regulation is going to cost too much? If so, how do you place a price tag on it?

Mr. HERHOLD. First of all, let me just say, as a citizen, I strongly support clean air and don't think we can or should put a price tag on it. But, as a businessman, I understand that for anything to work you need to have a return on your investment. Sometimes you can spend a lot of time and money on something and accomplish nothing.

Finally, as a boater, I can tell you that boaters demand no less than clean air and clean water, and anyone who works on the water or recreates on the water is a very environmentally sensitive, very environmentally tuned individual. In short, boaters will always vote for the environment.

In answer to your question, no, I don't think we can put a price tag on clean air.

Senator INHOFE. Are all boaters fat cats?

Mr. HERHOLD. No.

Senator INHOFE. I spent 40 years in aviation, and there always is this myth that floats around out there that all people in aviation—it's really a cross-section of America, and I would assume that boaters fall in that same category.

Mr. HERHOLD. You know, family recreational boating is as affordable as a second car. The real problem is a boat is purchased with discretionary income. People don't need boats like they need that first car, that second car, and they won't purchase a boat until they have the financial security, peace of mind that comes from, "Hey, I need some relaxation. I've got some money in my jeans. Let's go out and purchase a boat."

Senator INHOFE. Yes. There was a study done that was really revealing, I thought, back during 1993 when the Administration was proposing a very large luxury tax on both airplanes and boats, and it shocked a lot of people to see that they're not just talking about fat cats, as the Administration was implying.

Mr. HERHOLD. The lesson of the luxury tax was that the boaters voted with their pocketbook. They just simply didn't buy boats. I mean, that wasn't the way it was supposed to work, from the Government's point of view. But they either bought boats offshore from other countries and kept them offshore, which was damaging, or they just simply didn't buy them, or they kept the old boats. Normally you upgrade every 3 years or so.

Senator INHOFE. It's a jobs issue?

Mr. HERHOLD. Yes. Absolutely.

Senator INHOFE. Mr. Smith, I couldn't help but think—and I appreciate your very straightforward testimony and honesty that perhaps you could be a beneficiary of this if it came through. It's a little bit like H&R Block testifying to the Ways and Means Committee to complicate the tax forms.

[Laughter.]

Mr. SMITH. I think probably, quite apart from any parochial benefit to our industry, though, is the essential point in looking at cost, as you said in your opening remarks, that I think we are benefited by looking at the history of implementation of the Clean Air Act and the way those costs have gone.

Actually, I think that the control technologies that will be used—it's almost impossible to speculate what they'll be. They'll be site-specific. The city of Benton Harbor and the State of Michigan and

others will come up with control technologies that would suit the circumstances.

But I do think that probably the predominant way of compliance will be through pollution prevention approaches, eliminating the pollution in the first place, perhaps through devices and technology such as Mr. Heilman just mentioned. This is the first time I heard that.

I think, with regard to technology, in a lot of cases, Mr. Chairman, it's just going to be upgrading of existing technology rather than installation of new technology.

Senator INHOFE. Yes.

Mr. SMITH. Which is not good news for our industry. But I do appreciate that.

Senator INHOFE. I was saying that in jest, and I think you know that.

But I also wonder, because at previous hearings we've talked about this getting to $PM_{2.5}$, that the technology and the monitoring device and all that isn't there. You're in the business of getting people to comply and to clean up the air, which is good. I'm glad you're doing that. But if the technology is not there and the capability is not there to monitor for 2.5, how would you go about cleaning it up?

Mr. SMITH. My understanding from the technical experts in the industry is that this would not be a technology-forcing proposal. If you look at the fine PM, for example, in the eastern part of the United States, according to the EPA data, a lot of it is formed through emissions of sulphur dioxide and nitrogen oxide, which we have a very long record in controlling cost-effectively.

Senator INHOFE. Yes. All right. Well, I appreciate very much the time that you have given. You've certainly given a very broad perspective.

I have to say, back when I was mayor of Tulsa, Mr. Alford, Coleman Young and I became pretty close friends, and he familiarized me with some of the problems of which I was not familiar at that time with some of the large metropolitan areas, and the statistics that you have given us would be very, very helpful.

I think also the previous panel, in hearing testimony from the unfunded mandates, all too often, even though the law should have covered the private sector as well as political subdivisions, that was something we were able to get through, but we do intend to do it because I know it is significant. Unfunded mandates are just as damaging to the private sector as they are the public sector.

We thank you very much for coming. There will be more questions that will be forwarded to you to be answered for the record.

We appreciate your being here very, very much. Thank you.

We are now in recess. Thank you very much.

[Whereupon, at 4:42 p.m., the subcommittee was adjourned, to reconvene at the call of the chair.]

[Additional statements submitted for the record follow:]

STATEMENT OF EMMA JEAN HULL, MAYOR, BENTON HARBOR, MI

Good Day Ladies and Gentlemen, my name is Emma Jean Hull, Mayor of Benton Harbor, Michigan, and Treasurer of the National Conference of Black Mayors, Inc. and a member of its standing committee on Environmental Justice. Benton Harbor is located on the shores of Lake Michigan just an hour east of Chicago, Illinois and

45 minutes from Gary, Indiana. It is a minority/majority community with a population of 12,818, 97 percent African American, 40 percent under the age of 18. Benton Harbor through local partnerships with business and industry is just beginning to address some of the nation's highest at-risk factors in crime, unemployment and school-drop outs. Our success to date relies on local initiatives to retain, attract and grow small businesses, address workforce development and deal with environmental concerns—mostly related to our brownfield redevelopment projects.

SOME EXAMPLES OF BENTON HARBOR'S LOCAL PARTNERSHIP EFFORTS

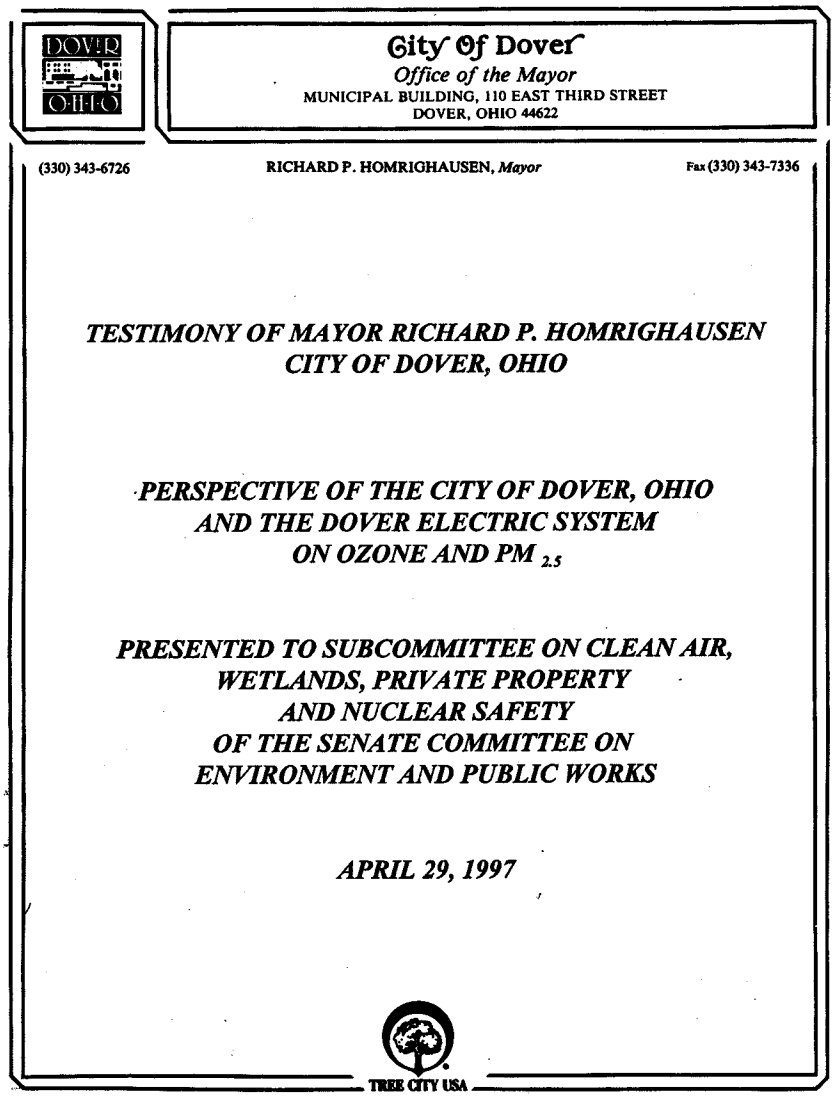
The city works in partnership with:

- Northside Business Association (27 minority businesses working with the chamber to promote minority leadership)
- SBA Technical Assistance Project (Lake Michigan College, Cornerstone Alliance, a local non-profit economic development corporation and city working to make individuals and small businesses bankable)
- Community Renewal through the Arts (28 area arts groups using the creative arts industry for economic development)
- Micro Loan Program (4 local lenders provide startup moneys for self sufficiency through self employment)
- Benton Harbor Skills Center (Benton Harbor Area Schools and Cornerstone to provide basic job and life skills training)
- Community Partnership for Life Long Learning (all area school systems working toward school to work and career based curriculum)
- Site Reclamation Grant to Redevelop Harbor (the State of Michigan and Alliance for multi-modal transportation center)
- Site Reclamation Grant for Buried Tank Removal (the State of Michigan)
- Purchase and Demolition of Deteriorated Industrial/Commercial Buildings (the State of Michigan and Cornerstone Alliance)

In the late 1970's and early 1980's, Benton Harbor saw the loss of over 3,000 manufacturing jobs with major plant closings in the steel, appliance and automotive industries. The remaining empty, deteriorating and in some instances contaminated buildings form both the core of our environmental problem and Benton Harbor's redevelopment potential. With passage of the 1990 Clean Air Act and the establishment of that year as the base line for attainment, my city was put at an immediate and distinct disadvantage. In 1990, Benton Harbor was at its lowest point for industrial activity. This artificially low standard for air quality, applied nationally without regard to local circumstances, is magnified by our proximity to both Chicago and Gary and the prevailing westerly winds. A fact that impacts the expansion of existing business and inhibits the location of new business in Benton Harbor as well.

The proposed and more stringent ozone standard and new PM standard for particulate matter emissions if implemented will directly impact on my community's efforts toward sustainable economic growth and development. The small businesses affected, many for the first time, like printers, bakers, service station operators and construction firms are the foundation of growing ranks of Benton Harbor's minority entrepreneurs. The anticipated higher production and operations costs required by the proposed standards coupled with regulatory burdens can restrict these businesses' expansion, impact their capital expenditures and eventually affect the jobs of many of our community's residents. This problem is only magnified when applied to new larger businesses. The ability to attract major new business and industry to brownfield sites is difficult. Benton Harbor and the Nation does not need any additional impediments.

Legislation is meaningless, unless implementation at the local level is assured. I support clean air and the intent of the Clean Air Act of 1990. I only ask that its implementation and any proposed change be fair, balanced and sensitive to the relationship between local government, industry and business—especially, as in Benton Harbor's case, small business. Partnership is a requirement of change. Please consider the impact the proposed changes will have on the local partnerships my community so desperately needs. Thank you for this opportunity to address this matter today.



City Of Dover
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DOVER, OHIO 44622

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TESTIMONY OF MAYOR RICHARD P. HOMRIGHAUSEN
CITY OF DOVER, OHIO

PERSPECTIVE OF THE CITY OF DOVER, OHIO
AND THE DOVER ELECTRIC SYSTEM
ON OZONE AND PM $_{2.5}$

PRESENTED TO SUBCOMMITTEE ON CLEAN AIR,
WETLANDS, PRIVATE PROPERTY
AND NUCLEAR SAFETY
OF THE SENATE COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS

APRIL 29, 1997

TREE CITY USA

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I. INTRODUCTION

Chairman Inhofe, Senator Graham, members of the Subcommittee, honored guests. I want to thank the Subcommittee for inviting me to testify regarding the United States Environmental Protection Agency's proposed new regulations on Ozone and $PM_{2.5}$. As you are well aware, EPA's proposal to increase the stringency of the ambient air quality standards for these pollutants under the Clean Air Act will have far reaching effects on each and every inhabitant of these United States of America. It is imperative that all voices be heard in the debate over these new regulations, the need for them, the science used to determine the proposed levels and the economic impact these proposed levels will have on every aspect of American life.

In particular, as a mayor of a vibrant community that operates a municipally-owned electric utility system, I want to emphasize the drastically disproportionate impact EPA's proposed standards could have on local governments and the small business entities operated by these communities. EPA has proposed drastic new standards that the Agency admits are not achievable for many communities, yet has failed to assess the costs and impacts that will be borne disproportionately by our communities and small businesses. These impacts will ultimately be placed on the citizens and consumers represented by cities like Dover, and served by public utilities like the City of Dover Electric System. In fact, EPA has admitted in its proposed rules that available control strategies may not be sufficient to allow counties to achieve attainment of the two proposed standards.[1]

Therefore, the City of Dover, along with Ohio Municipal Electric Association ("OMEA"), which represents Dover and 78 other municipal utilities, calls upon the Congress to ensure that EPA's proposed standards for ozone and particulate matter are both justified by sound science and health data, and take into account the particular impacts on local governments and small business entities. Specifically, Congress should ensure that:

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[1] *See Regulatory Impact Analysis for Proposed Ozone National Ambient Air Quality Standard, U.S. EPA Office of Air Quality Planning Standards, Innovative Strategies and Economics Group, December 1996 at p. E-12 Regulatory Impact Analysis for Proposed Particulate Matter National Ambient Air Quality Standard, U.S. EPA Office of Air Quality Planning Standards, Innovative Strategies and Economics Group, December 1996 at p. ES-12, ES-13.*

1. *The Environmental Protection Agency performs a full assessment of the potential costs and impacts of its proposed ozone and PM rules on small business entities and local governments, including public power entities, prior to the finalization of its standards and their implementation. EPA should be required under the Small Business Regulatory Enforcement Fairness Act to perform a SBREFA Regulatory Flexibility Analysis for both the standard-setting and implementation phases of its proposed ozone and PM revisions.*

2. *EPA devises a plan to ensure no disproportionate impact from its ozone and PM rules on small communities and public power entities. This plan should be developed with the substantial input of the affected local government and small business sectors.*

3. *EPA devises an implementation plan to provide the technical assistance and regulatory flexibility to small public power plants that will be necessary for these systems and units to comply with burdensome new regulations without being driven out of the competitive business.*

4. *Congress should statutorily exempt small utility units -- that is, units with under 25 megawatts of capacity - from additional control requirements for these pollutants, just as the Congress exempted small utility units from the Title IV control requirements for the acid rain program under the Clean Air Act Amendments of 1990.*

Once again, I thank you for the opportunity to come before you and give you the perspective of one small "Middle America" community.

II. BACKGROUND ON THE CITY OF DOVER

The City of Dover, Ohio is located in Tuscarawas County. Tuscarawas County with a population 84,400 and an area of 555 square miles, is situated in the northeastern portion of Ohio. Nearly 36 percent of the total population of the county, or approximately 30,000 inhabitants, is centered in the twin cities of Dover and New Philadelphia. Geographically, these two cities are located in the center of the county, where the majority of the commercial and industrial activity is also centered.

The City of Dover has a total land area of 5.75 square miles. It is located 80 miles south of Cleveland, 26 miles south of Canton,

90 miles west of Pittsburg, and 105 miles northeast of Columbus. The city is bounded to the south by the twin city of New Philadelphia, on the east by the Tuscarawas River, on the west by Interstate 77 and State Route 39, and on the north by the villages of Parral and Columbia.

Local employment is sustained by county wide industry. Dover and New Philadelphia have over 55 diversified industries which has eliminated the concern over the economic growth dependent upon one larger employer, thus allowing for a more secure job forecast for employees.

The local government of the City of Dover is of the Strong Mayor/ Council Statutory form. Elections are held on a partisan basis for the Mayor, Auditor, Treasurer, Law Director, President of Council, four Ward Councilmen, and three Councilmen-at-Large. A Director of Public Service, and a Director of Public Safety are appointed positions. This form of government is supplemented by the City Planning Commission and the Zoning Board of Appeals. The Mayor is the Chief Executive Officer of the city and is in charge of the operation of the city and the eleven city departments.

In 1992 my administration, with the help of a Citizens Advisory Committee, presented a plan which outlined a systematic approach to the renovation, repair, and expansion of our electric plant. This plan, called "Power-up 2000", responsibly provides for the growth of our electric utility in a way that does not place an unfair burden upon our residents. By setting aside 10% of the income generated by the light plant each year, we can plan for our future needs before they become problems. This plan is already proving its worth by the City's ability to bond $10.1 million for the installation of gas fired burners in boiler #4, at the local electric generation facility, the installation of a new Northern Innertie with the American Electric Power Company, and the renovation and expansion of our electric distribution system. Power-up 2000" enabled the city to make a down payment of $1.5 million on these projects which will save the city in excess of $5 million in debt service over the 25 year term of the notes.

**** FOR ADDITIONAL INFORMATION REGARDING THE CITY OF DOVER, SEE APPENDIX "A"*

III. CITY BUDGET - SPECIFICALLY LIGHT PLANT AND ELECTRIC DISTRIBUTION BUDGET

Dover's annual budget has steadily increased over the last five years. This is due in part to a strong economy and stable labor and employment market. The Light Plant and the Electric Distribution System accounted for $22,711,515.00 of the City's $45,047,297.00 annual budget for 1995, or 50.4%. Simple math tells the observer that the implementation of these new regulations will have a drastic effect on Dover's annual operating budget.

****** FOR A DETAILED LOOK AT THE ANNUAL BUDGET OF THE CITY OF DOVER, SEE APPENDIX "B".***

IV. OPERATION OF THE DOVER ELECTRIC SYSTEM

The City of Dover owns and operates its own electric system, including a generation plant, transmission interconnections and and electric distribution system. The Dover system purchases wholesale electric energy and power from other (typically investor-owned) utilities, through our membership in American Municipal Power-Ohio, Inc, which acts as our negotiating agent in power purchases. "AMP-Ohio" is a non-profit wholesale power supplier and service provider for 79 public power systems. The Dover electric power plant has instituted substantial environmental control measures in recent years, including an electrostatic precipitator and natural gas co-firing burners to reduce particulate emissions. We also shut down two coal fired boilers and installed a gas fired combustion turbine as replacement capacity. The Dover Electric System serves 6,185 customers, including residents, commercial and industrial operations, schools and the City's hospital. The City's Electric System plays a vital role in the competitive sale of power to Ohio consumers, supplying relatively low-cost energy to our customers.

Public power systems like Dover's play a vitally important role in our nation's communities and the competitive electric industry. U.S. public power utilities, which are community-owned, locally-controlled and not-for-profit, serve 1 in 7 Americans (35 million people) and collectively possess a $77

billion investment in all types of generation capacity, representing 8.7 percent of coal-fired, 15.5 percent of gas-fired and 9.7 percent of oil-fired generation capacity. Public power is inherently accountable to communities and their citizens, because they are owned and governed by these communities. Public power stands for the development of a viable and sustainable competitive wholesale market, improved environmental quality, and protection of the public interest against market power.

Indeed, public power systems are a relatively insignificant source of pollutant emissions and should not bear the brunt of stringent control requirements. A recent report by the Natural Resources Defense Council finds that 80% of electric utility No_x emissions in the 37 eastern states is produced by the top 50 generating companies. NRDC, Benchmarking Air Emissions of Electric Utility Generators In The Eastern United States P.11, (April, 97).

At the same time, public power is subject to anti-competitive threats from private, investor-owned electric utilities, and is disproportionately burdened by regulatory requirements. Public power systems and utility units, like Dover's, tend to be smaller and older than investor-owned systems and units.

These smaller public utilities often suffer from diseconomies of scale and bear particular burdens from technology-forcing requirements. These constraints on public power have been recognized by Congress both in energy legislation and environmental law, such as through the exemption of small utility units from Clean Air Act Title IV acid rain requirements. That is, Congress exempted small utility units -- those under 25 megawatts of capacity -- from the Title IV control requirements of the Clean Air Act Amendments of 1990, recognizing the relatively insignificant emissions and competitive importance of small utility units, which often cannot bear the same burdens as larger utilities. The Dover Generation plant is an example of a small utility unit that Congress recognized in the 1990 Amendments.

The City of Dover owns and operates its own electric generation plant. The City's main source of generation is through the burning of local coal mined in the Tuscarawas Valley. In 1995 the City installed two gas burners in the City's boiler #4. These burners enable the Light Plant to start up with gas and to co-fire gas with

coal during normal operations. With the gas burners' installation, the Light Plant has experienced a two to three percent increase in efficiency at low gas firing rates and are able to start up the plant without the normal four to six hours of excess capacity.

At the same time the gas burners were installed, the controls for boiler #4 were upgraded. With the new controls and the gas burners the Light Plant has increased the load of boiler # 4 by 5%. The combination of these two improvements not only increases the efficiency of boiler #4 but it creates a much cleaner burn, which in turn aids in the protection of the environment.

Approximately 15.5 megawatts of Dover's load is generated by the power plant and another 18 magawatts is obtained through purchased power. The plant has an annual generating peaking capacity of 32.5 megawatts, using the coal fired boiler, a combustion turbine, and an internal combustion diesel generator. The average summer time peak of 39 plus megawatts is met through generation and long term purchase of power contracts. Our various resources are scheduled by economic dispatch to provide our rate payers low cost, reliable electric service. This is done through our membership in AMP-Ohio, who acts as our negotiating agent in power purchases.

The City of Dover also operates a distribution system within the city, known as the Electric Field Distribution Division. This division is responsible for maintaining the distribution system in a secure and reliable condition while meeting the City's growing electrical needs. This system includes 85 miles of distribution lines and 5 pole miles of transmission lines, along with two substations, numerous transformers and over 7,400 meters.

The Division has always been a progressive and innovative part of the utility, from installing submarine cables under the Tuscarawas River in 1935, to being the first Ohio municipal electric system to install fiber-optic cables as a communication link between the plant and a substation.

The Division has completed many major projects, including the construction of 2.5 miles of 69KV lines to the North Substation in 1987. In 1995, the Division completed a program converting street lighting to high-pressure sodium lighting.

Since 1989, the Electric Filed Division has operated the City's south substation as a temporary installation. After an electrical trans-

mission and distribution system study, it was recommended the City construct an interconnection substation north of the City. This north substation will improve the capacity and reliability of the transmission system, the distribution system, and the interconnection with American Electric Power. This northern interconnection will be completed in the latter part of 1997.

V. DISCUSSION OF PERTINENT QUESTIONS REGARDING USEPA PROPOSED REGULATIONS AND THEIR IMPACT ON DOVER

1.) WHAT ARE THE CURRENT LEVELS OF EMISSIONS FROM THE DOVER LIGHT PLANT FOR SO_2, NO_X, AND CO, IN RELATIONSHIP TO OUR PERMITTED LEVELS UNDER THE 1990 CAA?

	TONS COAL	TONS SO_2	TONS NO_X	TONS CO	TONS PARTICULATE
PERMIT LEVELS	N/A	4,976.56	N/A	N/A	248.83
1992-1996 AVERAGE	45,751	1,796.445456	325.692	114.3785	72.050631592

At the present time we only have permitted levels on SO_2 and Total Particulate Matter, because that is all that is required by the (SIP) State Implementation Plan. As can be seen, our average tested emission levels, for total Particulate Matter, are only 28.9%, and for SO_2 are only 36% of our permit levels. SO_2 emissions are based upon the sulfur content of the coal burned. Even though our SO_2 emissions are well below our permitted levels, the City of Dover, in a conscious effort to improve the air we breath, installed natural gas co-firing burners in 1995. These burners not only further reduce our SO_2 emissions, but they also reduce Particulate Matter emmissions by improving efficiency through increased carbon burnout.

The above calculations for NO_X and CO_2 levels were calculated using the EPA's AP-42 method. However, if monitoring of modeling data suggest that an ambient air quality standard is being violated, then limits for other pollutants may be imposed.

2.) WILL EPA's PROPOSED NEW STANDARDS PUT THE CITY OF DOVER AND TUSCARAWAS COUNTY IN NONATTAINMENT?

EPA's proposed ozone standard would likely throw Dover and Tuscarawas County into ozone nonattainment. The proposed $PM_{2.5}$

standard may also put the City and County in nonattainment, although it is difficult to determine because Dover, like most other cities, does not currently monitor for PM-fine. The Ohio EPA has monitored tropospheric ozone for a long time. At the proposed standard, past monitoring shows the Tuscarawas County would qualify as a non-attainment area. This conclusion is verified by USEPA's press release that lists Tuscarawas County as a non-attainment area under the new standard. Ozone concentrations are falling and will continue to fall in the near future as existing regulations continue to maximize their effect. However, the rate of decrease will not be enough to compensate for the radical decrease in the standard being proposed.

Because $PM_{2.5}$ has not been extensively monitored in Ohio, no one knows for sure how it will impact attainment status. USEPA has projected that the most urban counties will be unable to comply with this standard. These are the areas that are currently monitored. I suspect that many more areas, especially those with significant coal combustion facilities, will be considered non-attainment areas as more monitoring and modeling data becomes available.

3.) WHAT EFFECT COULD EPA's PROPOSED STANDARDS HAVE ON THE CITY OF DOVER, THE DOVER ELECTRIC SYSTEM AND THE CITY'S RESIDENTS AND CONSUMERS?

EPA's PROPOSED STANDARDS COULD REQUIRE BURDENSOME TECHNOLOGY-FORCING COMPLIANCE REQUIREMENTS THAT WILL DISPROPORTIONATELY BURDEN SMALL UTILITIES LIKE THE DOVER POWER PLANT.

The EPA's proposed stringent new ozone and PM standards could have a drastic and disproportionate impact on small, publicly-owned utility systems like the Dover Electric System. Although the exact compliance requirements that might be imposed on Dover cannot be determined until the EPA implementation process is completed, Ohio's "State Implementation Plan" is developed and detailed economic analyses are performed by Dover to determine the impact of these rules on the City, certain results are likely.

First, the EPA ozone and PM rules would likely require significant reductions in emissions of oxides of nitrogen ("NO_x") by utilities. EPA efforts related to the Ozone Transport Commission and the Clean Air Power Initiative suggest that utilities may be forced to

reduce NO_X emissions by as much as 60-75 percent. Such NO_X reductions may force the City of Dover Municipal Power Plant to install control technology including "low-NO_X burners," "Selective Catalytic Reduction technology," or "Selective Non-Catalytic Reduction technology."

Second, the EPA PM-fine rule, which could require utilities to reduce gaseous nitrogen and sulfur precursors of particulate matter, could require further imposition of expensive control technology on the Dover Municipal Power Plant, including the upgrade of its existing electrostatic precipitator, or the installation of new baghouse equipment.

In addition, the need to control gaseous sulfurs under the proposed PM standard could require further reductions in SO_2 emissions by utilities, which could require utility units like Dover's to switch to lower sulfur coal or even install SO_2 scrubbers at considerable cost.

As explained earlier, these technology-forcing requirements that would likely result from EPA's new rules will be difficult, if not impossible, for small utility units like Dover to bear. For example, economic studies by other municipal utilities have estimated that the cost of SCR technology on a utility unit of 25 megawatts or less could cost up to $400 per kilowatt - a level that cannot be sustained in a competitive electric industry.

The modification of the ozone and PM NAAQS cannot be divorced from the impacts and costs that will be associated with the required implementation of revised standards. Such impacts will be borne disproportionately by small public power systems and units like those owned by the City of Dover. Indeed, the adverse impacts on Dover's electric system from an increase in the stringency of the PM and ozone standards could pose an almost insurmountable competitive disadvantage to small utility systems as the electric utility industry prepares to enter a new, competitive era. These disproportionate impacts from the implementation of the ozone and PM NAAQS are recognized by the EPA itself in its Regulatory Impact Analyses for the two proposed rules.

EPA itself recognizes the drastically disproportionate burden that would be placed upon small utility systems by the proposed revisions to the ozone and PM NAAQS. For example, the Economic Assessment of the Regulatory Impact Analysis for the proposed ozone standard indicates that the economic impact of the proposed

ozone rule would be THREE TIMES greater on "SMALL utility entities" as compared to all utility entities. In the Ozone RIA, EPA measures the "cost-to-sales" ratios on a wide range of industrial categories associated with various control measures that would be necessary to meet the proposed ozone standard. The EPA analysis adopts a "standard rule of thumb" that recognizes an impact of a regulation to be a "significant impact on small entities" when 20% or more of the affected small entities[2] have an expected cost of regulation to sales ratio of equal to or greater than 3%. See Ozone Regulatory Impact Analysis at pp. VIII-1 and VIII-2. The Ozone RIA estimates that utility boilers overall will have a cost-to-sales ratio of 7.3% - which is over twice the level determined "significant" by EPA's impact standard. More importantly, the cost-to-sales ratio estimated for small utility boilers is over three times that level for utilities in general, at a 22.6% ratio.[3] Moreover, the EPA economic impact estimates recognize that "average cost per establishment does not always account for plant size (and)...any economies and diseconomies of scale associated with controlling large plants compared to controlling smaller plants." Ozone RIA at VIII-23. Particularly when emissions compliance requirements force the application of a particular technology (such as selective catalytic reduction or "SCR" as may be necessary for the control of utility ozone precursors and particulate matter), the diseconomies of scale for pollution control at small utility units can be substantial.

The disproportionate impact on small utility units from the control requirements associated with the proposed ozone standard cannot be doubted.

The same disproportionate burden on small utility systems occurs under the proposed PM standard. In the PM RIA, EPA performs a cost-to-sales ratio screening analysis to identify those industries or source categories potentially experiencing impacts from the proposed regulations. The EPA analysis shows that the proposed PM standard impact on "small" (i.e. 100 employees or less) establishments would result in 53 industrial categories experiencing a substantial cost-to-sales ratio of 10% and above, as opposed to an

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[2] *The ozone and PM RIAs adopt a generic definition of "small entities" to include entities with 100 employees or less. The City of Dover Municipal Electric Plant falls within this definition, as well as the "small entity definition" that applies to electric utilities under the Small Business Regulatory Enforcement Fairness Act.*

[3] *Ozone RIA at Table D-4, p. D-8, D-9*

impact on all establishments (i.e., both small and non-small) resulting in only 27 industrial categories experiencing the high, 10% or above cost-to-sales ratio. PM RIA at p. 8-15, 8-16. In other words, more than twice as many industrial categories will experience this substantial economic impact when the impact is measured on small business entities only, as opposed to all business entities.
Or, as recognized by EPA, (t)here is some evidence...that there may be potentially significant impacts on 10 to 20 percent of all U.S. industries (represented by SIC codes), and potentially significant impacts on small establishments only in 15 to 25 percent of all U.S. industries." PM RIA at 8-17.

These drastically disproportionate impacts from EPA's proposed new rules are not abstract to communities like Dover.
To comply with these rules would force existing sources to spend considerable sums of money in an effort to reach attainment status. This expense has not been planned for and would need to be recovered. If the increased cost cannot be recovered through rates, then either tax revenues will need to be increased or the city budget will need to be cut in other areas.

Implementation of these strategies will require the expenditure of capital funds and will increase the cost of operations. The strategy of switching to a low sulfur, higher cost coal will result in the City of Dover purchasing coal from outside the state of Ohio. Therefore, the City of Dover would no longer be purchasing $1,040,000.00 worth of coal from local suppliers, but rather would be purchasing between $1,240,000.00 and $1,440,000.00 worth of coal from out of state suppliers, thereby having a detrimental impact on the state's coal mining industry. Depending on the control strategies implemented, the capital costs could easily be in the millions of dollars. All of these costs will be passed on to our citizens in the form of increased rates.

If these costs become too large, the City of Dover may be forced to close the Municipal Power Plant, thereby eliminating employment for 20 people at the plant. The plant has proven to be a valuable asset for the city for the past 87 years, and is a main reason why the city has been able to provide its citizens with low cost electricity. Closing down the power plant will make the City of Dover less competitive in the electric industry and may lead to the evidential elimination of the City's Municipal Electric System. Although the electric utility industry is entering a competitive new era, neither wholesale or retail electric competition is in place yet,

and anti-competitive threats and market power abuses may exist, or even increase, as de-regulation is implemented. If municipal power systems like Dover's are disproportionately impacted and hobbled by regulatory requirements, these public power entities will be less able to respond flexibly to customer needs at a time when the risks are greater.

These significant, disproportionate costs on small utility systems like Dover's could potentially force many small municipal systems out of business. Without the benefit of detailed economic studies, it is difficult to say for sure. However each additional regulation places additional burdens on the city generating plant. It must be pointed out that the Dover Light Plant is small, generating 15 megawatts on an average basis, in comparison to most investor-owned utilities. There is a natural tendency for expensive solutions to be easier to make for large plants, because the cost can be spread over a much larger customer base.

Over the years, the City of Dover has reduced emissions from its generating plant while being able to provide competitively priced electricity to its citizens. The proposed NAAQS would raise the cost of power to our citizens and jeopardize the city's capability to provide competitive services in the electric industry even though the benefits to the public health from the new rules and regulations are still uncertain.

THE BURDEN OF EPA's RULES ON THE CITY OF DOVER'S ELECTRIC SYSTEM WILL ADVERSELY IMPACT DOVER'S CITIZENS AND CONSUMERS.

If EPA's proposed rules and their likely technology-forcing effect do not put the Dover Electric System out of business, they will certainly have a direct negative impact on the community's citizens and consumers. If we were to assume that we could still purchase electricity at the same rate of our current purchased power contracts that the city had to generate electricity via the burning of natural gas (because burning Ohio coal would be prohibited), and were maintaining our basic electric rates at current levels, a typical Dover electric bill each month would increase as follows due to the fuel switching required by the EPA rules.

	CURRENT	PROJECTED
Residential (2,000 Kwh)	$120.00	$150.00
Industrial (300,000 Kwh)	$13,153.00	$16,907.00
Union Hospital (455,000 Kwh)	$19,376.00	$25,965.00
Commercial (4,000 Kwh)	$ 314.00	$ 400.00

As can be seen in the above projection electric rates for customers of Dover Power would dramatically increase in the attempt to bring the city's electric plant into compliance with these new regulations. In addition to the rate increase caused by compliance, the city has built in subsequent rate increases to pay for the Municipal Electrical System Revenue Bond issue of $10,075,000.00 dated 1995 to 2020 with increasing principle and interest rates over the 25 year period. The purpose of this issue is to improve the city's municipal electrical system both in reliability and environmental aspects. Increasing the electric rates for both of these issues would virtually eliminate the city's ability to generate electricity competitively as it has for the past 87 years. An additional impact on the city budget would be disproportionate wage increases for all city employees to keep in step with the increased cost of living caused by the artificial inflationary effect of complying with these new rules and regulations.

Additional impacts specific to the City of Dover Municipal Electric Generating System could result from EPA's proposed rules. The Power Plant and the Field Division employ a total of 33 people, 20 of which are employed at the Power Plant. The Power Plant annually burns 40,000 tons of locally mined Ohio coal at an annual cost of $1,040,000.00. The shut-down of the plant due to disproportionate regulatory burdens could thus result in a substantial loss of jobs or decrease in the use of locally mined coal.

EPA's PROPOSED RULES COULD ALSO HARM COMMUNITIES BY THWARTING ECONOMIC DEVELOPMENT AND PUSHING NEW DEVELOPMENT INTO THE NATION'S GREENFIELDS AND PRIME AGRICULTURAL AREAS

Stifled economic development for attracting new business, business expansion, and retaining existing businesses will be the primary product of these new regulations. Any new or expanding business contemplating the construction of facilities in the area will not only spend additional money on air pollution control equipment but will spend additional time procuring environmental permits. With a limited number of offsets available in Tuscarawas County (due to

non-attainment status), it may be impossible to obtain the offsets needed to permit any new development. The end result will be a negative impact on the Dover and Tuscarawas County economy. Rural, greenfield attainment areas will be more attractive because the regulations are not as stringent and the threat of additional reductions in the future is not as strong. Encouraging business development in the nation's greenfields while viable urban areas decay seems counterproductive to improving the environment.

WHAT ROLE DID/DOES THE EPA'S "CLEAN AIR SCIENTIFIC ADVISORY COMMITTEE (CASAC) PLAY IN THESE PROPOSALS?

As you know the CASAC is a committee primarily made up of scientific individuals that review the criteria documents and staff papers submitted to them by the USEPA on their proposed regulations. CASAC'S duty is to review these documents and advise the USEPA Director whether or not to implement said proposed regulations.

George T. Wolff, Chairman of the EPA's Clean Air Scientific Advisory Committee, and Principal Scientist for General Motors Corporation, in a report printed in EM, (September,1996) a publication of the Air & Waste Management Association, cited CASAC'S interpretations and recommendations as follows:

"The Panel felt that the weight of the health effects evidence indicates that there is no threshold concentration for the onset of biological responses due to exposure to ozone above background concentrations. Based on information now available, it appears that ozone may elicit a continuum of biological responses down to background concentrations. It should be noted that a biological response does not necessarily imply an adverse health effect. Nevertheless, this means that the paradigm of selecting a standard at the lowest-observable-effects-level and then providing an "adequate margin of safety" is not possible. It further means that risk assessments must play a central role in identifying an appropriate level.

To conduct the risk assessment, EPA had to identify populations at risk and the physiological responses of concern, develop a model to estimate the exposure of this population to ozone, and develop a model to estimate the probability of an adverse physiological response to the exposure. EPA selected a small segment of the population, 'outdoor children' and 'outdoor workers', particularly

those with preexisting respiratory disease as the appropriate populations with the highest risks. The Panel concurred with the Agency that the models selected to estimate exposure and risk were appropriate models. <u>However, because of the myriad of assumptions that are made to estimate population exposure and risk, large uncertainties exist in the model estimates."</u>(emphasis added)

"Of the 10 members who voiced an opinion, all endorsed an 8-hour standard and all endorsed multiple exceedances. Three members recommended 0.08 ppm which is clearly more stringent than the present NAAQS. Three other members recommended 0.09 ppm and one member recommended a range of 0.09 to 0.10 ppm which, with multiple allowable exceedances, ranges from NAAQS equal in stringency to the current NAAQS to a NAAQS less stringent to the current NAAQS. Two other members (including the author) said it is a policy decision because the science has not shown any of the alternatives that are being considered as being more protective of public health than any other. This can be interpreted as a vote of support for an 8-hour NAAQS equivalent in stringency to the current NAAQS." ..."<u>In summary, although the panel members' opinions differed, none supported the lower end of EPA staff's recommendations, and the majority of the members stated a position which included an 8-hour NAAQS of equivalent stringency to the present 1-hour NAAQS of 0.12 ppm."</u> (emphasis added)

Why then does the USEPA continue to press forward with their proposed 0.08 ppm in direct conflict with the recommendations of its own Clean Air Scientific Advisory Committee?

In the October, 1996 Issue, of the same publication, discussing USEPA's proposed regulations on $PM_{2.5}$ Mr. Wolff reported the following: "Estimated $PM_{2.5}$ concentrations were calculated for all counties with PM_{10} samplers by multiplying the relatively abundant PM_{10} data by ratios derived from a much more limited $PM_{2.5}/PM_{10}$ database. At present, 12% of the counties with monitors exceed the PM_{10} standard, mostly due to exceedances of the 24-hour NAAQS. A combined annual 24-hour $PM_{2.5}$ NAAQS of 25-75 ug/m^3 results in approximately the same number of counties not in attainment (15% versus 12%) but these combined levels are above the range recommended in the SP (staff paper). The least stringent combined NAAQS within the Agency's recommended range is 20/65 ug/m^3 which results in 24% of the counties not in attainment. At 15/50 ug/m^3 the percentage soars to 56%, and as the lower end of EPA's

range is approached, virtually the entire country is out of compliance." (emphasis added)

Once again the various Panel members had a diversity of opinion regarding allowable levels of $PM_{10}/PM_{2.5}$. "The diversity of opinion expressed by the Panel members reflected the many unanswered questions and large uncertainties associated with establishing causity of the association between $PM_{2.5}$ and mortality."
... "Because of measurement errors, the present statistical methodologies are incapable of detecting the existence of a possible threshold concentration below which acute mortality would not occur. Finally, there is some concern because the statistical models used in the various geographical areas are different. At different sites, different combinations of variables, averaging times, methods for accounting for seasonality and meteorology, and lag times have been used to produce the reported PM-mortality relationships." The bottom line is: CASAC stated: "...there does not appear to be any compelling reason to set a restrictive $PM_{2.5}$ NAAQS at this time." (emphasis added)

Why then does the USEPA continue to press forward with their proposed $PM_{2.5}$ in direct conflict with the recommendations of its own Clean Air Scientific Advisory Committee?

From Policy Study Number 136, Has the Battle Against Urban Smog Become "Mission Impossible?" by Kenneth W. Chilton and Stephen Huebner, regarding the reduction of ozone: "Another important consideration is the attainability of any air quality standard for ozone. Natural emissions from trees and other vegetation can release enough chemicals (volatile organic compounds) to lead to ozone levels that are very close to the level being advocated by the American Lung Association - 0.07 ppm. Indeed eight-hour daily average levels as high as 0.072 ppm have been recorded in Theodore Roosevelt National Park in North Dakota. Thus, too tight a standard could literally be "mission impossible."

How does the USEPA propose to regulate a naturally occurring phenomenon?

ARE UTILITIES REALLY TO BLAME FOR AN OZONE PROBLEM?

The Midwest Ozone Group produced a study in December, 1996 which challenged EPA's assumption pollution from utilities represents a large piece of 'unfinished business' for the nation.

The MOG study entitled: "From Ozone Attainment, Proceeding in the Right Direction, Will sound science and objectivity prevail?" states as follows:

"Overall, electric utilities contribute less than 17 percent of all ozone precursor emissions while the transportation (vehicular) sector contribute 41 percent and the industrial sector about 37 percent. Utilities contribute approximately 33 percent of NO_x and less than 0.2 percent of VOCs."

EMISSION INVENTORY ISSUES

"An emission inventory is the identification of emission sources and the rate of their emissions which provides essential data (inputs) for the model. Unfortunately, there is no way of generating an ozone modeling emission inventory at this time that accurately describes an ozone episode....While the use of profiles in the absence of actual operating and/or emissions data is accepted modeling technique, the use of default profiles almost always generates an inventory larger than actually occurred during the episode being modeled. In a review of the modeling inventory for the 1995 OTAG episode conducted by Enviroplan which looked at only utility sources, it was determined that emissions from the identifiable portion of the utility sources in the modeling inventory were overstated by roughly 34% when the inventory was compared to Continuous Emission Monitoring System (CEMS) data collected and reported by utilities under the Acid Rain program."

CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY

"OTAG, under great pressure from USEPA, has not reached the conclusions on long range transport expected by USEPA and has been forced to proceed on such a tight schedule that sound science and objectivity are compromised. With USEPA's November 8, 1996 announcement of its intention to make Advance Notice of Proposed Rulemaking in December, 1996 on regional NO_x reductions to reduce ozone transport, it is obvious that OTAG and other scientific studies are now being preempted by USEPA. The ozone nonattainment issue has been transformed into an ozone transport issue that is being driven by politics and not science and objectivity."

"The ozone nonattainment issue is one that challenges some of the fundamental public policy decisions of the nation and threatens to

impose significant new costs on numerous entities. As such, it is imperative that OTAG and USEPA look at this problem from an objective point of view. Significant NO_x reductions are or will be achieved through Title IV of the CAA Amendments of 1990 by the year 2000. It is premature for USEPA to reach a conclusion on the need for further NO_x reductions outside of ozone nonattainment areas, before the Title IV NO_x reductions are fully implemented and evaluated for their impact on ozone concentrations. To further complicate the issue, USEPA has proposed revisions to the ozone standard."

"Ozone nonattainment is a problem that must be solved using sound science and not politics. It is critical that OTAG assure the strategies they recommend will achieve the goal of ozone attainment. It is also critical that USEPA take the opportunity to look at this issue objectively with participation from all affected parties. When a scientifically based conclusion is finally reached, if it is determined that one or more specific source categories are playing a large part in the ozone nonattainment problem in any nonattainment area, then each such source category should be asked to do its part in reducing emissions of ozone precursors."

VI. HEALTH DATA

The following information has been obtained from the records of Union Hospital, located in the City of Dover, regarding the documented occurrences of the following upper respiratory ailments during the years 1992 through 1996.

Upper Respiratory Infection

	1992	1993	1994	1995	1996
Inpatient	30	20	17	8	8
Emergency	1102	1764	1683	2062	1859

Laryngotracheobronchitis

	1992	1993	1994	1995	1996
Inpatient	10	26	5	7	6
Emergency	54	93	67	95	82

Pneumonia

	1992	1993	1994	1995	1996
Inpatient	57	48	40	31	4
Emergency	53	41	39	70	70

Asthma

	1992	1993	1994	1995	1996
Inpatient	127	78	67	77	65
Emergency	295	383	340	516	502

Total Emergency Room visits for the same period is as follows:

	1992	1993	1994	1995	1996
Total E.R. Visits	21,252	23,976	24,235	26,097	27,198

The steady increase in the number of emergency room visits over the five year period is due a $8.3 million expansion of the Hospital completed in 1993. In addition, there has been an increase in the number of physicians based at the Hospital and the implementation of a new Emergency Room Trauma program, which has permitted the various emergency transport services to choose Union Hospital as their primary transport choice. Union has also embarked on a comprehensive EMTA program which is centered in the Emergency Room area, and which provides support and service to the areas emergency services.

One would suppose that reducing emissions would improve the health of our citizens, and this was largely true for most of the early history of the Clean Air Act. However, I think it is safe to say that we have reached a period of diminishing returns - perhaps a period of no returns at all. Even EPA's own science advisors admit that the more stringent ozone standard will not significantly improve public health.

One of the principle health studies that USEPA used to calculate health benefits found that if compliance with the proposed ozone standard is achieved, there would be a reduction of less than one percent in the hospital visits per year in the New York City area for asthma related illnesses (Ohio EPA Director Don Schregardus, January 29, 1997 testimony before Ohio Senate Energy, Natural Resources and Environment Committee. Recall that incidence of asthma continues to increase while the air is getting cleaner, (as is evidenced by the figures for Union Hospital shown above). Perhaps the billions of dollars at stake here would be better spent on health care facilities, doctors and research.

Dover does not have, nor do we expect to have a health problem associated with air pollution. Again, the air is getting cleaner and we expect this trend to continue. It is possible that reducing emissions of NO_x could actually increase ozone concentrations. Under certain conditions, NO_x actually strips ozone from the air. If NO_x and VOC's are not reduced in the right proportion, it is possible that utility reductions may increase the concentration of tropospheric ozone. Assuming EPA's assertions of ozone impacts on public health are correct, such action may contribute to the problem. While this scenario is unlikely, it is possible if the EPA zealously pursues NO_x reductions MERELY FOR THE SAKE OF REDUCTION!

From the pamphlet "Breathing Easy with Asthma", published by Marion Merrell Dow, Inc.:

"While we know that asthma tends to run in families, no one knows why certain people get it. We do know that many different things can cause an asthma attack. These are called "triggers." You can prevent episodes of breathing difficulties if you understand your personal triggers and learn how to avoid them. Not all asthma sufferers react to the same triggers, but here are some of the most common ones:

INFECTIONS. ...colds and other upper respiratory infections can trigger asthma symptoms...recurring sinus infections also may contribute to asthma.

ALLERGIES. Among the common allergens are (1) pollen from trees, grasses, ragweed, and other weeds, (2) molds, which are found outdoors and indoors, (3) animal skin, hair, saliva, and feathers, (4) house dust and the waste products of dust mites (microscopic creatures), especially in the bedroom.

EXERCISE. Exercise is good for many people, even people with asthma. But people with asthma tend to have problems with a variety of forms of exercise. Luckily before you begin exercising, you can take medication to block an asthma attack. In fact, treatment works so well that there are many people with asthma among the world's top athletes, including Olympic medalists.

CHEMICALS AND TOBACCO SMOKE. Some people are sensitive to substances without being allergic to them. You should not smoke and should avoid tobacco smoke. Other triggers may include the chemicals in household products like cleaners, solvents, paints, and chlorine bleach and even personal grooming products such as deodorants, hair spray, perfume and cosmetics. Fumes and dust encountered on the job can also lead to asthma attacks.

EMOTIONS. Asthma is not a mental or emotional disease, but strong emotions like excitement, fear and anger can affect breathing and may aggravate asthma.

MEDICATIONS. Certain medications can cause some people to have more problems with their asthma.. These include aspirin, ibuprofen and related drugs and beta-blockers used to treat high blood pressure, migraine headaches and glaucoma.

WEATHER AND AIR POLLUTION. Your asthma may be very sensitive to weather, especially unusual cold or heat and humidity or

wind and weather changes. Air pollution, which can be made worse by weather, is another problem.

GASTROESOPHAGEAL REFLUX. Sometimes stomach acid can flow up into your esophagus and trigger an attack.

My personal experience as an asthmatic and as the father of an asthmatic makes me especially concerned about the causes and triggers of asthma.

It also makes me particularly aware that EPA's studies may not have accounted for the causes, other than ozone and particulate matter, of asthma attacks. In relation to the above explanation of asthma, I have the following personal observations to make.

As an asthmatic and the father of an asthmatic I know the problems asthmatics face on a day-to-day basis. In our family's case our asthma is largely triggered by allergies. Mowing the lawn can at times be sheer agony if the proper precautions have not been taken to keep our allergies in check, and playing a round of golf can be misery, (apart from the scoring process), if the same precautions are not taken.

I knew when my son was two months old that he had asthma. He wheezed, coughed, and sneezed when he was exposed to cold air, and allergens.

However, as asthmatics, my son and I know what precautions we need to take in order for us to perform certain tasks and/or exercises. Likewise, the prudent asthmatic should learn to make allowances for their asthma.

For myself, I get allergy shots on a monthly basis, take allergy pills and use an inhaler on a daily basis. My son, who excels in cross country, takes three different inhalers daily. Yet during certain meets, when the course goes through wooded areas and near farms, he still has problems.

I wonder if the study the USEPA did involving children at summer camp is flawed. Anyone with asthma knows that the spring and summer are some of the worst times for asthma related incidents. All plants, trees, grasses, and weeds are in full bloom producing pollen one of the main aggravations for asthmatics. Choosing the location for a study on asthmatics, which one would assume would have wooded areas, makes the resultant data appear worse than it really is.

VII. SUMMATION

In conclusion, the City of Dover and its municipal electric system, along with Ohio Municipal Electric Association and its members, wish to convey that EPA's proposed standards for ozone and particulate matter are likely to have a burdensome, drastically-disproportionate impact on small utility systems and the local governments that own and operate them. These impacts could force public power systems out of business, or at the least impose substantially higher power costs upon our citizens and customers. Such an impact has not been adequately assessed nor justified by the Environmental Protection Agency. For these reasons, the City of Dover and Ohio Municipal Electric Association respectfully request the Congress to ensure that EPA fully assess the costs and impacts of its proposed standards upon local governments and small businesses, including public power, prior to the implementation of such standards. Further, I encourage the Congress to ensure that the EPA develop and implement a plan to avoid any disproportionate impact from its air standards on small public power units, including through the use of regulatory flexibility, technical assistance and market incentives, all of which will be necessary for small public power generators to implement such stringent, technology-forcing requirements.

APPENDIX "A"

BACKGROUND ON THE CITY OF DOVER, OHIO

A.) REGIONAL DATA

The topography of the county is rolling to hilly with an average precipitation of 38 inches of rainfall per year. Temperatures range from a January average of 23.2 degrees to July with an average of 75 degrees. The mean temperature is 50.3 degrees with an annual frost free period of 150 days.

Categorized by property type, 48.8 percent of the region's land area is comprised of farms, totaling 1,287 in total.

Tuscarawas County ranks 12th statewide in land area and 32nd in total population, indicating a lower than average population density.

B.) COMMUNITY DATA

LAND USE AND HOUSING

The City of Dover is primarily a residential community and is noted for its older elegant homes built on quiet tree-lined streets. Characteristically, Dover is a commercial area and is the leading industrial city in Tuscarawas County.

The following is a break down of the total land use for the City of Dover:

31.4%	Residential
9.0%	Commercial
10.5%	Industrial
6.0%	Public and Institutional
3.2%	Open Space and Recreation
5.2%	Agricultural
7.1%	Vacant
27.7%	Street & Rail Right-of-Ways
64.40	Miles of Streets
75.03	Miles of Water Lines
59.45	Miles of Sanitary Sewer Lines
28.99	Miles of Storm Sewer Lines
85	Miles of Electric Distribution Lines

The City's housing market is characterized by low vacancy rates and a high percentage of owner-occupied units. Approximately 73% of the City's housing units are occupied by the property owners.

The average cost of home ownership in Dover has steadily increased over the last 5 years. The average sales price for the years 1992-1996 is as follows:

1992	***$70,399.34***
1993	***$76,147.70***
1994	***$80,386.97***
1995	***$83,737.20***
1996	***$93,927.86***

ACCESSIBILITY AND TRANSPORTATION:

Dover is easily accessible due to the number of major transportation arteries which serve the city. Interstate 77 runs north/south connecting Dover with the larger industrial cities to the north and with Interstate 70, a major east/west route, 40 miles to the south. Interstate 77 interchanges are located on the city's west side.

Additional routes are: U.S. Route 21 and State Routes 800, 21, 211, 250, and 416. Thirty common motor freight carriers serve the area, and three bus lines provide passenger service to and from the area. Freight service is also provided by the R.J. Corman Railroad, which transports over the CSX Rail System.

There is no public intra city bus service. However, senior citizen bussing is provided on a five-day per week basis, which provides transportation to and from shopping areas, hospitals and other necessary services.

Harry Clever Municipal Airport is situated in the adjacent city of New Philadelphia with a paved runway of 3,950 feet and lighted for 24-hour use providing for private and corporate air travel. The quality of the airport for the size of the area has been an advantage in attracting major industry to the area. Canton-Akron Airport, with full service, is within a 45 minute drive to the north.

SCHOOLS

The City's public school system consists of three elementary schools, one middle school, and one high school. The total elementary enrollment is 1,275 pupils, middle school enrollment is 750 pupils, and the high school enrollment is 860 pupils. Average teacher to student ratio in all the grade levels is 1:21.6.

The Dover School system is ranked as one of the best in the State of Ohio. The Dover Middle School has been recognized as the #1 Middle School in the state for the past two years, for their facilities, and curriculum.

Dover also has one elementary parochial school. Tuscarawas Central Catholic High School is located in New Philadelphia, and is accessible to the residents of Dover and the remainder of the county residents.

Buckeye Career Center provides on the job vocational training for all county students who so desire, and is located in New Philadelphia.

All of the school systems are fully accredited and maintain an excellent overall and academic reputation.

Kent State University, Tuscarawas County Campus, offers two-year associate degree programs and selected baccalaureate and graduate offerings. Four-year degree programs are in the fields of Business Administration, Technology, Nursing, and Management and Industrial Studies, which further the educational opportunities available to Dover and Tuscarawas County residents.

Dover is served by the Tuscarawas County District Library with full audio-visual facilities and 103,000 volumes, as well as by the Dover Public Library.

HOSPITALS

Union Hospital, situated in the City of Dover, has just completed a 8.3 million dollar expansion program. New Emergency Room and Trauma facilities, as well as, new Laboratory facilities, ICU Unit, Radiology, and Surgical Units have been renovated and expanded in this full service 220 bed facility. In addition, a full service outpatient mental health facility is located adjacent at the hospital site.

PARKS AND RECREATION

Dover has 113 plus acres devoted to its parks system. The major portion is located at the Dover City Park, where 103 acres of land provides baseball, basketball, tennis, swimming, football, picnicking, walking, jogging, and an amphitheater, as well as all related recreational opportunities for the residents of the community.

Four public golf courses are within a 12-minute drive, as well as one private country club located within the city limits. The Tuscarawas County YMCA, located within the city, has just completed a 3.5 million dollar renovation program. This facility provides year-round recreational activities for the residents of Dover and Tuscarawas County.

CHURCHES

The City of Dover is served by 23 Protestant and one Catholic Church.

COMMUNICATIONS

One daily newspaper, The Times-Reporter, with a circulation of 35,400 on a seven-day per week basis services the area. Three radio stations with AM-FM programming are available, as well as television service from Cox Cable TV.

SOCIAL AND ECONOMIC FACTORS

Analysis of the total work force in Dover indicates that 73 percent work within the Dover/New Philadelphia area, with a combined percentage of 85.7 percent of the total work force residing in Dover, working somewhere within Tuscarawas County. Of this work force, 14.3 percent work outside the county the majority of which work in Stark County to the north.

UTILITIES AND SERVICES

Water is provided from the city well fields which produce 1,000,000 gallons of water per day. The city is in the process of constructing a new water treatment plant, adjacent to the well field, which will supply chlorinated drinking water to the community. The sanitary sewer plant is adjacent to the Tuscarawas River and treats an average of 1.5 million gallons of water per day.

Telephone service is provided by the General Telephone Company of Ohio. Gas is provided by the East Ohio Gas Company and electricity is provided by the Dover Municipal Power Plant.

POLICE AND FIRE PROTECTION

Dover is served by a 22 member police force and a 16 member fire department. Two fully equipped ambulances manned by the Dover Fire Department provide full paramedic service to the Dover residents. In addition, the fire department has a fully accredited Hasmat response team.

INCOME TAX

The City of Dover has a one percent income tax initiated to provide required income for operational purposes.

APPENDIX "B"

OPERATION OF THE CITY OF DOVER, OHIO
CITY BUDGET
FOR PERIOD ENDING
DECEMBER 31, 1995

City of Dover, Ohio
Combining Statement of Revenues, Expenses
and Changes in Retained Earnings
All Enterprise Funds
For the Year Ended December 31, 1995

	WATER	ELECTRIC	SEWER	TOTALS
Operating Revenues:				
Charges for Services	$1,483,648.00	$10,604,143.00	$1,461,937.00	$13,549,728.00
Tap-In Fees	2,549.99	0.00	25.00	2,574.00
Other	6,876.00	22,311.00	1,360.00	30,547.00
Total Operating Revenues	1,493,073.00	10,626,454.00	1,463,322.00	13,582,849.00
Operating Expenses:				
Salaries and Wages	400,617.00	1,378,878.00	516,162.00	2,295,657.00
Fringe Benefits	134,542.00	489,605.00	190,748.00	814,895.00
Contractual Services	109,857.00	756,397.00	131,137.00	997,391.00
Materials and Supplies	52,161.00	1,251,059.00	102,684.00	1,405,904.00
Purchased Power	0.00	4,556,639.00	0.00	4,556,639.00
Depreciation	142,097.00	659,840.00	349,649.00	1,151,586.00
Total Operating Expenses	839,274.00	9,092,418.00	1,290,380.00	11,222,072.00
Operating Income	653,799.00	1,534,036.00	172,942.00	2,360,777.00
Non-Operating Revenues (Expenses):				
Interest	311,332.00	468,108.00	21,435.00	800,875.00
Gain on Disposal of Fixed Assets	1,400.00	0.00	6,000.00	7,400.00
Interest and Fiscal Charges	(239,388.00)	(382,901)	(109,931.00)	(732,220.00)
Total Non-Operating Revenues (Expenses)	73,344.00	85,207.00	(82,496.00)	76,055.00
Income Before Operating Transfers	727,143.00	1,619,243.00	90,446.00	2,436,832.00
Operating Transfers Out	(14,241.00)	(49,694.00)	(23,426.00)	(87,361.00)
Net Income	712,902.00	1,569,549.00	67,020.00	2,349,471.00
Retained Earnings (Deficit) Beginning Year	2,353,241.00	8,228,698.00	(864,923.00)	9,717,016.00
Retained Earnings (Deficit) Ending Year	$3,066,143.00	$9,798,247.00	($797,903.00)	$12,066,487.00

City of Dover, Ohio
Combining Balance Sheet
All Enterprise Funds
December 31, 1996

	WATER	ELECTRIC	SEWER
ASSETS:			
Equity in Pooled Cash & Cash Equivalents	$343,526.00	$1,784,371.00	$533,464.00
Cash & Cash Equivalents with Fiscal Agents	2,275.00	925.00	19,573.00
Receivables:			
Accounts	223,759.00	1,647,306.00	209,325.00
Intergovernmental	0.00	0.00	1,544.00
Accrued Interest	48,976.00	147,017.00	0.00
Prepaid Items	37,706.00	96,983.00	39,138.00
Materials and Supplies			
Inventory	101,441.00	687,426.00	15,868.00
Deferred Charges	146,619.00	263,718.00	24,840.00
Total Assets	904,302.00	4,627,746.00	863,752.00
Restricted Assets:			
Equity in Pooled Cash and Cash Equivalents	6,059,017.00	7,281,235.00	405,926.00
Cash & Cash Equivalents with Fiscal Agents	563,721.00	857,369.00	0.00
Total Restricted Assets	6,622,738.00	8,138,604.00	405,926.00
Fixed Assets (Net of Accumulated Depreciation)	4,070,882.00	9,945,165.00	9,468,182.00
Total Assets	$11,597,922.00	$22,711,515.00	$10,737,860.00
LIABILITIES:			
Accounts Payable	$42,228.00	$693,329.99	$9,003.00
Contracts Payable	563.00	254,084.00	797.00
Accrued Wages	14,118.00	50,310.00	18,492.00
Compensated Absences Payable	0.00	1,765.00	944.00
Intergovernmental Payable	22,857.00	100,726.00	40,564.00
Retainage Payable	0.00	0.00	19,573.00
Matured Interest Payable	2,275.00	925.00	0.00
Accrued Interest Payable	34,561,00	57,892.00	17,579.00
Notes Payable	0.00	0.00	300,000.00
Current Portion of General Obligation Bonds Payable	0.00	130,000.00	55,000.00
Current Portion of Revenue Bonds Payable	130,000.00	215,000.00	0.00
Total Current Liabilities	246,602.00	1,504,031.00	461,952.00
Payable from Restricted Assets:			
Customer Deposits	0.00	62,126.00	0.00
Total Liabilities Payable from Restricted Assets	0.00	62,126.00	0.00
Long Term Liabilities:			
Compensated Absences	121,215.00	347,423.00	137,279.00
General Obligation Bonds Payable (Net of Current Portion)	0.00	1,210,000.00	1,185,000.00
Revenue Bonds Payable (Net of Current Portion)	6,300,000.00	9,655,000.00	0.00
Total Long-Term Liabilities	6,421,215.00	11,212,423.00	1,322,279.00
Total Liabilities	6,667,817.00	12,778,580.00	1,784,231.00
FUND EQUITY:			
Contributed Capital	1,863,962.00	134,688.00	9,751,532.00
Retained Earnings:			
Reserved for Replacement	438,358.00	1,782,091.00	0.00
Unreserved (Deficit)	2,627,785.00	8,016,156.00	(797,903.00)
Total Fund Equity	4,930,105.00	9,932,935.00	8,953,629.00
Total Liabilities and Fund Equity	$11,597,922.00	$22,711,515.00	$10,737,860.00

City of Dover, Ohio
Combined Statement of Revenues, Expenses
and Changes in Retained Earnings/Fund Balance
All Proprietary Fund Types and Non expendable Trust Fund
For the Year Ended December 31, 1995

	Proprietary Fund Type	Fiduciary Fund Type		
	Enterprise	Internal Service	Nonexpendable Trust	Totals (Memorandum Only)
OPERATING REVENUES:				
Charges for Services	$13,549,728.00	535,150.00	$16,306.00	$14,101,184.00
Tap-In Fees	2,574.00	0.00	0.00	2,574.00
Interest	0.00	0.00	17,969.00	17,969.00
Other	30,547.00	0.00	0.00	30,547.00
Total Operating Revenues	13,582,849.00	535,150.00	34,275.00	14,152,274.00
OPERATING EXPENSES:				
Salaries and Wages	2,295,657.00	0.00	0.00	2,295,657.00
Fringe Benefits	814,895.00	0.00	0.00	814,895.00
Contractual Services	997,391.00	107,742.00	36.00	1,105,169.00
Materials and Supplies	1,405,904.00	0.00	0.00	1,405,904.00
Purchased Power	4,556,639.00	0.00	0.00	4,556,639.00
Claims	0.00	415,988.00	0.00	415,988.00
Depreciation	1,151,586.00	0.00	0.00	1,151,586.00
Total Operating Expenses	11,222,072.00	523,730.00	36.00	11,745,838.00
Operating Income	2,360,777.00	11,420.00	34,239.00	2,406,436.00
NON-OPERATING REVENUES (EXPENSES):				
	800,875.00	2,640.00	0.00	803,515.00
Interest	7,400.00	0.00	0.00	7,400.00
Gain on Disposal of Fixed Assets	(732,220.00)	0.00	0.00	(732,220.00)
Interest and Fiscal Charges	76,055.00	2,640.00	0.00	78,695.00
Total Non-Operating Revenues (Expenses)	2,436,832.00	14,060.00	34,239.00	2,485,131.00
Income Before Operating Transfers	(87,361.00)	0.00	(20,000.00)	(107,361.00)
Operating Transfers Out	2,349,471.00	14,060.00	14,239.00	2,377,770.00
Net Income				
Retained Earnings/Fund Balance Beginning of Year	9,717,016.00	100,002.00	450,986.00	10,268,004.00
Retained Earnings/Fund Balance End of Year	$12,066,487.00	$114,062.00	$465,225.00	$12,645,774.00

City of Dover, Ohio
Combined Statement of Revenues, Expenditures and Changes in Fund Balances
All Governmental Fund Types and Expendable Trust Funds
For the Year Ended December 31, 1995

	Governmental		
REVENUES:	General	Special Revenue	Debt Service
Municipal Income Tax	$1,030,615.00	$605,000.00	$0.00
Property and Other Taxes	711,497.00	89,700.00	0.00
Charges for Services	606,219.00	161,549.00	0.00
Fines, Licenses and Permits	35,356.00	2,429.00	0.00
Intergovernmental	869,614.00	580,217.00	0.00
Contributions and Donations	0.00	0.00	0.00
Interest	209,825.00	11,460.00	0.00
Other	17,648.00	1,909.00	0.00
Total Revenues	3,480,774.00	1,452,264.00	0.00
EXPENDITURES:			
Current:			
General Government	606,666.00	0.00	23.00
Security of Persons and Property	1,911,037.00	288,707.00	0.00
Public Health Services	11,410.00	239,619.00	0.00
Transportation	0.00	714,379.00	0.00
Community Environment	62,724.00	148,273.00	0.00
Basic Utility Services	389,391.00	0.00	0.00
Leisure Time Activities	419,187.00	0.00	0.00
Capital Outlay	0.00	0.00	0.00
Debt Service:			
Interest and Fiscal Charges	0.00	0.00	0.00
Total Expenditures	3,400,415.00	1,390,978.00	23.00
Excess of Revenues Over (Under) Expenditures	80,359.00	61,286.00	(23.00)
OTHER FINANCIAL SOURCES (USES):			
Sale of Fixed Asset	0.00	0.00	0.00
Operating Transfers In	85,370.00	20,000.00	0.00
Operating Transfers Out	0.00	0.00	(822.00)
Total Other Financial Sources (Uses)	85,370.00	20,000.00	(822.00)
Excess of Revenues & Other Financing Sources Over (Under) Expenditures & Other Financing Uses	165,729.00	81,286.00	(845.00)
Fund Balances (Deficit) Beginning of Year	594,650.00	291,020.00	845.00
Increase (Decrease) in Reserve for Inventory	8,939.00	(24,855.00)	0.00
Fund Balances (Deficit) End of Year	$769,318.00	$347,451.00	$0.00

Fund Types	Fiduciary Fund Types	
Capital Projects	Expendable Trust	Totals (Memorandum Only)
$973,476.00	0.00	$2,609,091.00
0.00	0.00	801,197.00
0.00	13,014.00	780,782.00
0.00	0.00	37,785.00
388,068.00	0.00	1,837,899.00
20,000.00	0.00	20,000.00
16,072.00	3,847.00	241,204.00
14,525	0.00	34,082.00
1,412,141.00	16,861.00	6,362,040.00
0.00	126.00	606,815.00
0.00	0.00	2,199,744.00
0.00	10,724.00	261,753.00
0.00	0.00	714,379.00
0.00	0.00	210,997.00
0.00	0.00	389,391.00
0.00	0.00	419,187.00
1,687,320.00	0.00	1,687,320.00
124,009.00	0.00	124,009.00
1,811,329.00	10,850.00	6,613,595.00
(399,188.00)	6,011.00	(251,555.00)
380,000.00	0.00	380,000.00
123,700.00	0.00	229,070.00
(120,887.00)	0.00	(121,709.00)
382,813.00	0.00	487,361.00
(16,375.00)	6,011.00	235,806.00
(791,626.00)	75,864.00	170,753.00
0.00	0.00	(15,916.00)
($808,001.00)	$81,875.00	$390,643.00

City of Dover, Ohio
Combined Balance Sheet
All Fund Types and Account Groups
December 31, 1995

	Government Fund Types			
	GENERAL	SPECIAL REVENUE	DEBT SERVICE	CAPITAL PROJECTS
ASSETS AND OTHER DEBITS:				
ASSETS:				
Equity in Pooled Cash & Cash Equivalents	$666,478.00	$274,876.00	$0.00	$2,173,860.00
Cash & Cash Equivalents with Fiscal Agents	0.00	2,253.00	1,733.00	97,126.00
Receivables:				
Taxes	817,183.00	179,503.00	0.00	96,000.00
Accounts	62,133.00	0.00	0.00	0.00
Intergovernmental	102,831.00	28,986.00	0.00	0.00
Accrued Interest	50,444.00	0.00	0.00	0.00
Loans	0.00	101,053.00	0.00	0.00
Prepaid Items	31,528.00	5,083.00	0.00	0.00
Materials and Supplies Inventory	45,546.00	59,176.00	0.00	0.00
Deferred Charges	0.00	0.00	0.00	0.00
Restricted Assets:				
Equity in Pooled Cash & Cash Equivalents	0.00	0.00	0.00	0.00
Cash & Cash Equivalents with Fiscal Agents	0.00	0.00	0.00	0.00
Funds on Deposit with Deferred Compensations Boards	0.00	0.00	0.00	0.00
Fixed Assets (Net, where applicable, of Accumulated Depreciation)	0.00	0.00	0.00	0.00
OTHER DEBITS:				
Amount to be provided for Retirement of General Long-Term Debt	0.00	0.00	0.00	0.00
Total Assets and Other Debits	$1,776,143.00	$650,930.00	$1,733.00	$2,366,986.00

City of Dover, Ohio
Combined Balance Sheet
All Fund Types and Account Groups (Continued)
December 31, 1995

	Governmental Fund Types			
	General	Special Revenue	Debt Service	Capital Projects
Liabilities, Fund Equity and Other Credits:				
LIABILITIES:				
Accounts Payable	$25,651.00	$33,834.00	$0.00	$78,134.00
Contracts Payable	60,778.00	20,197.00	0.00	59,996.00
Accrued Wages	81,319.00	25,732.00	0.00	0.00
Compensated Absences Payable	2,111.00	1,369.00	0.00	0.00
Intergovernmental Payable	88,783.00	115,591.00	0.00	0.00
Deferred Revenue	748,183.00	104,503.00	0.00	0.00
Retainage Payable	0.00	2,253.00	0.00	97,126.00
Matured Interest Payable	0.00	0.00	1,733.00	0.00
Accrued Interest Payable	0.00	0.00	0.00	44,731.00
Notes Payable	0.00	0.00	0.00	2,895,000.00
Claims Payable	0.00	0.00	0.00	0.00
Payable from Restricted Assets:				
Customer Deposits	0.00	0.00	0.00	0.00
Deferred Compensation Payable	0.00	0.00	0.00	0.00
Police & Fire Pension Liability	0.00	0.00	0.00	0.00
General Obligation Bonds Payable	0.00	0.00	0.00	0.00
Revenue Bonds Payable	0.00	0.00	0.00	0.00
Total Liabilities	1,006,825.00	303,479.00	1,733.00	3,174,987.00
Fund Equity & Other Credits:				
Investment in General Fixed Assets	0.00	0.00	0.00	0.00
Contributed Capital	0.00	0.00	0.00	0.00
Retained Earnings:				
Reserved for Replacement	0.00	0.00	0.00	0.00
Unreserved	0.00	0.00	0.00	0.00
Fund Balances (Deficit):				
Reserved for Encumbrances	63,775.00	4,984.00	0.00	979,506.00
Reserved for Inventory	45,546.00	59,176.00	0.00	0.00
Reserved for Endowments	0.00	0.00	0.00	0.00
Reserved for Loans Receivable	0.00	101,053.00	0.00	0.00
Unreserved, Undesignated	659,997.00	182,238.00	0.00	(1,787,507.00)
Total Fund Equity (Deficit) & Other Credits	769,318.00	347,451.00	0.00	(808,001.00)
Total Liabilities, Fund Equity & Other Credits	$1,776,143.00	$650,930.00	$1,733.00	$2,366,986.00

Proprietary Fund Types		Fiduciary Fund Types	Account Groups		
Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long-Term Obligations	Totals (Memorandum Only)
$2,681,361.00	$157,779.00	$547,100.00	$0.00	$0.00	$6,501,454.00
22,773.00	0.00	0.00	0.00	0.00	123,885.00
0.00	0.00	0.00	0.00	0.00	1,092,686.00
2,080,390.00	0.00	0.00	0.00	0.00	2,142,523.00
1,544.00	0.00	0.00	0.00	0.00	133,361.00
195,993.00	0.00	0.00	0.00	0.00	246,437.00
0.00	0.00	0.00	0.00	0.00	101,053.00
173,827.00	0.00	0.00	0.00	0.00	210,438.00
804,735.00	0.00	0.00	0.00	0.00	909,457.00
435,177.00	0.00	0.00	0.00	0.00	435,177.00
13,746,178.00	0.00	0.00	0.00	0.00	3,746,178.00
1,421,090.00	0.00	0.00	0.00	0.00	1,421,090.00
0.00	0.00	1,905,194.00	0.00	0.00	1,905,194.00
23,484,229.00	0.00	0.00	4,292,443.00	0.00	27,776,672.00
0.00	0.00	0.00	0.00	1,089,530.00	1,089,530.00
$45,047,297.00	$157,779.00	$2,452,294.00	$4,292,443.00	$1,089,530.00	$57,835,135.00

(continued)

Proprietary Fund Types		Fiduciary Fund Types	Account Groups		
Enterprise	Internal Service	Trust and Agency	General Fixed Assets	General Long-Term Obligations	Totals (Memorandum Only)
$744,560.00	$0.00	$0.00	$0.00	$0.00	$882,179.00
255,444.00	0.00	0.00	0.00	0.00	396,415.00
82,920.00	0.00	0.00	0.00	0.00	189,971.00
608,626.00	0.00	0.00	0.00	745,735.00	1,357,841.00
164,147.00	0.00	0.00	0.00	0.00	368,521.00
0.00	0.00	0.00	0.00	0.00	852,686.00
19,573.00	0.00	0.00	0.00	0.00	118,952.00
3,200.00	0.00	0.00	0.00	0.00	4,933.00
110,032.00	0.00	0.00	0.00	0.00	154,763.00
300,000.00	0.00	0.00	0.00	0.00	3,195,000.00
0.00	43,717.00	0.00	0.00	0.00	43,717.00
62,126.00	0.00	0.00	0.00	0.00	62,126.00
0.00	0.00	1,905,194.00	0.00	0.00	1,905,194.00
0.00	0.00	0.00	0.00	343,795.00	343,795.00
2,580,000.00	0.00	0.00	0.00	0.00	2,580,000.00
16,300,000.00	0.00	0.00	0.00	0.00	16,300,000.00
21,230,628.00	43,717.00	1,905,194.00	0.00	1,089,530.00	28,756,093.00
0.00	0.00	0.00	4,292,443.00	0.00	4,292,443.00
11,750,182.00	0.00	0.00	0.00	0.00	11,750,182.00
2,220,449.00	0.00	0.00	0.00	0.00	2,220,449.00
9,846,038.00	114,062.00	0.00	0.00	0.00	9,960,100.00
0.00	0.00	0.00	0.00	0.00	1,048,265.00
0.00	0.00	0.00	0.00	0.00	104,722.00
0.00	0.00	464,997.00	0.00	0.00	464,997.00
0.00	0.00	0.00	0.00	0.00	101,053.00
0.00	0.00	82,103.00	0.00	0.00	(863,169.00)
23,816,669.00	114,062.00	547,100.00	4,292,443.00	0.00	29,079,042.00
$45,047,297.00	$157,779.00	$2,452,294.00	$4,292,443.00	$1,089,530.00	$57,835,135.00

PREPARED STATEMENT OF LEON G. BILLINGS, DELEGATE, MARYLAND GENERAL ASSEMBLY

Mr. Chairman, I am a State legislator with a unique perspective. Not only do I live in the suburbs of the nation's capital, but I spent 15 years on the staff of the U.S. Senate, 12 of which were as staff director of this Subcommittee when it was chaired by Senator Edmund S. Muskie of Maine.

I represent the legislative district which reaches from the District line several miles into Maryland on both sides of Connecticut Avenue. While it is considered a wealthy district, it is quite economically and ethnically diverse. It has some of the highest incomes in Montgomery County and some of the lowest.

My constituents are very strongly committed to environmental protection. I would hazard a guess that my constituents care at least as much about the Chesapeake Bay as people who depend on a healthy Bay environment for their livelihood. My constituents also care very deeply about the quality of the air we breathe.

As a measure of concern, Mr. Chairman, I would point out that during the entire controversy surrounding Maryland's newly required enhanced motor vehicle inspection program, I did not receive a *single* communication from *any constituent* protesting the new dynamometer test. In fact, nearly 50 percent of Montgomery County motorists voluntarily take the dynamometer test. So, perhaps it will not surprise you that I support these new, more strict ambient air quality standards—as a good representative of my district. I say this because air pollution's victims often are those least able to defend themselves—the very young, the chronically ill, the elderly. I also support them as a grandfather of four and, because I am now classified as an "older American," I support them for personal reasons.

The State of Maryland has done a great deal to clean up its air pollution. We've had centralized auto emission testing for 17 years and voluntary dynamometer testing for more than 2. Our power plants and factories have made great strides toward reducing emissions as their part of complex plans to achieve current ambient air quality standards.

Many businesses and industries in Maryland believe that they are being required to make extra investments to control pollution because large industrial sources and power plants in Virginia, West Virginia, Ohio, Indiana and Pennsylvania are doing too little to control their emissions. These Maryland businesses have argued against further reductions in emissions from Maryland sources until something is done about these big polluters to our west and south.

Thus, for the people of Maryland, these new standards have two important benefits:

1. They will provide additional health protection for our citizens, especially our children and our elders; and

2. They could reduce the burden on Maryland businesses by more fairly allocating the responsibility for cleanup to the large sources—sources that today are uncontrolled or poorly controlled—sources whose emissions are transported to us from other States to us.

It is interesting to note that the people who challenge these new standards generally are not scientists but representatives of institutions that pollute. American business and industrial interests simply don't want to pay more money to achieve a greater level of pollution control. But that is nothing new. I began my service to this committee in 1966. Every single environmental proposal this Committee recommended to the Senate, usually unanimously, was met with the charge that it was too expensive.

In 1970, then-Ford executive Lee Iacocca called the Clean Air Act "a threat to the entire American economy and to every person in America." He was wrong, of course. Today's cars are marvels of engineering. And the Big Three automakers recently announced *first quarter* profits totaling more than $4.5 billion.

The rhetoric in today's debate is much the same. What *is* new is the 271 peer reviewed air pollution health studies EPA evaluated prior to proposing the new standards. What is new is there is so much science to support standards. When the first Federal air quality information was published in 1966–67, there was a crescendo of criticism regarding the adequacy of data. Compared to today's information base, those critics were on sound ground.

Mr. Chairman, in this context I would like to make an historical point. I find it ironic that the National Association of Manufacturers and its allies are protesting these new national ambient air quality standards. Prior to 1970, ambient air quality standards were adopted by localities in their air quality control regions based on citizen input and local perceptions of the threat of air pollution. That process proved unacceptable *to industry* because the standards proposed were often more strict than might be indicated by the federally published air quality criteria documents.

In 1970, the Nixon Administration proposed and Congress adopted national ambient air quality standards. The decision to adopt national ambient air quality standards was widely advocated and supported by the nation's major polluting industries. They were the ones who wanted to use *government science* as the basis for air quality standards. They were the ones that wanted *EPA* to adopt the air quality standards. They were the ones who wanted to avoid the proliferation of and often differing air quality standards around the country.

Now EPA is doing the job that business wanted and Congress adopted in 1970. And now NAM and its allies don't like the result so they want to change the rules of the game.

EPA has nearly 30 years of experience and, as many lawsuits have affirmed, it is good at its job.

I would encourage this Committee to tell the NAM and the Citizens for a Sound Economy and the various other groups who have lined up on the anti-clean air bandwagon to quit trying to change the rules that they helped make.

Their opportunity to affect the cost of achieving these standards will come in the implementation phase. We are currently in the information stage. And the American people have a right to know the levels of air pollution which affect their health.

Congress has *never* compromised this right to know. Congress has on two occasions, 1977 and 1990, provided more time to implement health based standards—in 1977, up to 10 years more; and in 1990, up to 20 years.

But Congress has *never* bowed to pressure to compromise science. To do so would make a process of public health protection *political* rather than scientific.

EPA has evaluated the science and proposed its judgment. The appropriate focus for this Committee and the Congress will be to assure a balanced and timely implementation of the standards that recognizes the economic needs and interests of industry and the need that millions of vulnerable Americans have for protection from the impact of smog on their lives.

Congress has been doing *that* job for 30 years. We have proved that we can have a healthy and growing economy while moderating the health impact of pollution. And we have done so without compromising the public's right to know what healthy air ought to be.

Thank you.

HOUSE OF DELEGATES,
Annapolis, MD, May 16, 1997.

Hon. JAMES M. INHOFE, *Chair,*
Subcommittee on Air, Wetlands, Private Property and Nuclear Safety,
Committee on Environment and Public Works,
U.S. Senate, Washington, DC.

DEAR SENATOR INHOFE: Thank you again for the opportunity to participate in your recent hearings on the newly proposed national ambient air quality standards. I particularly appreciate the opportunity to respond to the questions Senator Baucus submitted in writing.

Answer to Question 1. Prior to 1970, the Federal Clean Air Act provided for the consideration of economic and technological feasibility with respect to a number of the regulatory requirements authorized. The 1970 Act eliminated considerations of economic and technical feasibility with respect to most regulatory authority which impacted on health standards. But in the history of Federal clean air law there has never been any economic feasibility analysis required of the health-related ambient air standards, though from time to time that has been proposed unsuccessfully by polluting industries.

The most significant debate over including a cost factor with respect to ambient standards occurred during the debate over the Public Health Service's publication of an Air Quality Criteria document for sulfur dioxide. Coal and related industries argued that publication of data on the effects of sulfur dioxide on health should be accompanied by an analysis of the cost of achieving levels of air quality which would reflect those criteria. To the best of my recollection, this proposal never advanced to the stage of a legislative amendment because it was absurd on its face, as has been the discussion of cost in association with the current ambient air quality standards.

While the terminology has changed over thirty years, the facts remain the same: air quality standards are nothing more or less than the best professional judgment of the Environmental Protection Agency and its scientific advisors on the levels of air pollution at which health effects occur. Senator Muskie and his colleagues on

the committee on which you now serve unanimously agreed time and again that the public had a right to know the level of air pollution at which their health may be put at risk. They also unanimously agreed that when regulators and the Congress decided how and when those standards would be achieved, that would be the appropriate time for consideration of economic and technical feasibility.

As Senator Howard H. Baker stated at a hearing on air quality standards on July 29, 1968:

> "Air Quality criteria are intended to delineate, on the basis of the best available scientific and medical evidence, the effects of individual contaminants, combinations of contaminants, or categories of contaminants or the constantly changing, somewhat indeterminate environment of man. Thus, economic and technological considerations are not relevant with regard to the establishment of ambient air quality criteria; they will be given full attention in the standard-setting procedures."

Answer to Question 2. As I indicated in my testimony, prior to 1970 the Federal air quality criteria information (the data which indicated what scientists said were the levels of air pollution at which health effects occurred) were made available to State and local air pollution control agencies for the purpose of determining air quality standards and establishing implementation plans. A review of the hearings held in the late 1960's and early 1970's by the subcommittee which you now chair would reveal that not only did community-based air quality standards decisions result in very rigorous demands for protection from air pollution, but they triggered a significant level of citizen activism. "Citizens for Clean Air" groups sprang up across the country. In the eyes of many, air quality standards became a political decision, not a health-based scientific judgment.

The Nixon Administration, responding to the business community, decided that a Federal Government scientific judgment was preferable to the politically powerful clean air demands of citizen activists. The result was the 1970 Act provision for national ambient air quality standards. Thus, because the national ambient air quality standards are a product of a Republican President responding to demands of the business community, you can appreciate why I find today's opposition to national standards by the business community and many Republican leaders to be so ironic.

I hope these answers are responsive to your needs. If I can be of further assistance, please let me know.

Sincerely,

LEON G. BILLINGS.

PREPARED STATEMENT HON. RICHARD L. RUSSMAN, STATE SENATOR FROM NEW HAMPSHIRE

Mr. Chairman and members of the subcommittee, my name is Richard Russman, and I am a State senator from New Hampshire. I want to thank you for this opportunity to testify about the clean air standards for ozone and particulate matter that have been proposed by the Environmental Protection Agency (EPA).

As you know, New Hampshire is one of the northeastern States that is affected by ozone transport, so we have a very strong interest in seeing action taken to address the emission of precursors that lead to ozone formation. The respiratory problems caused by excessive ozone exposure will continue to plague the citizens of my State, not to mention the health of natural resources, if action is not taken. In addition, I believe the people of New Hampshire agree that the threat of fine particulate matter must be addressed, as called for by the American Lung Association and our Governor, the Honorable Jeanne Shaheen.

I understand that this subcommittee is concerned about the process undertaken by the EPA in promulgating rules to address ozone and particulate matter problems. Let me say at the outset, I am a proponent of the proposed rules and believe the EPA is going about the process of issuing final rules in a responsible manner. These standards must be established by relying on health based criteria only; that is very specific in the Clean Air Act.

Recently, the National Conference of State Legislatures (NCSL) sent a letter to Ms. Mary Nichols, Assistant Administrator for Air and Radiation at EPA, citing numerous problems with the issuance of the proposed rule and compliance with Federal statutes and executive orders. I disagree with the premise and findings of that letter and, as the core of my testimony, I will explain my reasoning to the members of the subcommittee today.

First let us remember that this is a proposed rule—not final. Many of the arguments raised against the rule are based on the requirements necessary when an

agency promulgates a final rule. For that reason alone, many of the arguments raised by the NCSL have no validity.

Second, many opponents criticize EPA for not seeking outside opinions or consultation with the States. Nothing could be further from the truth. Since February, 1994, EPA Administrator Browner has been seeking the advice of affected parties on the issuance of these rules. Under the authority of the Federal Advisory Committee Act (FACA), EPA established working groups to address ozone, particulate matter and regional haze problems. These working groups depend upon the opinions of State and local governments, industry, small businesses and other interested parties to formulate strategies for attainment.

These strategies are designed to help States with implementation programs, which are solely a State and local government responsibility. I do not believe the EPA simply is passing the buck when they claim they are not demanding specific regulatory activities. As you know, the EPA grants authority to the States to implement the rules as they see fit through a State implementation plan. The NCSL recognizes this in its letter to the EPA, stating that implementation of the Clean Air Act is being carried out by State and local governments."

I don't believe it would be a stretch to say that the Congress and much of the country would be up in arms if the EPA directed the specific actions that States and localities must take. States have asked for and been given authority to implement many Federal regulations. This is one of those cases where granting primacy (regulatory authority) has and should continue to work.

In addition to bringing in the views of affected parties through the FACA process, EPA extended the comment period on the rule for 21 days. That extension has allowed more than 40,000 comments to be received via the mail and nearly 18,000 phone and electronic comments to be delivered.

The date for issuing the final rule also was extended after a request by the Administrator. It is important to note that the opponents of the rule were the primary constituency asking for that extension. In response to this, Ms. Browner returned to the judge who issued the initial ruling on particulate matter and petitioned for the delay.

Finally, since issuing the proposed rules, EPA has expanded the representation on the PACA working groups to include more representatives from local governments and small businesses. These actions were not required, but were carried out by the EPA to ensure adequate input from those expressing most concern. Not once in their letter does the NCSL recognize these ongoing efforts.

With the chairman's approval, I would like to submit for the record the membership of those working groups so that members of the committee will have an idea of the access that various interests have had to the rulemaking process.

One concern raised by the NCSL letter that I would like to reinforce to you is the issue of funding. We all agree there will be some costs in implementing these rules, although those costs are several years away. With this in mind, the concern about section 105 funding, which provides technical and financial assistance to States, is one that is universal among States. Realizing the role that States and localities play in implementing the nation's environmental laws, I hope the Congress will see the wisdom in providing adequate funding to the EPA to assist in this implementation.

While I am not a member of President Clinton's party, I would like to state that I commend him for the efforts he has made to reform the regulatory process. Since 1993, with the issuance of Executive Order 12866, this administration has made a concerted effort to streamline regulations and to provide justifications for rulemaking. While cost benefit analyses are not a criteria of the Clean Air Act, the EPA complied with the Executive Order and provided the necessary justifications, including analyses of costs and benefits, to the Office of Information and Regulatory Affairs (IRA) at the Office of Management and Budget (OMB). Your committee and the entire Congress has access to these documents, which I suspect are more thorough than documentation for any other rule the EPA has ever promulgated

In addition to administrative efforts to improve regulatory efficiency, the Congress passed and the President signed numerous pieces of legislation, specifically the Small Business Regulatory Enforcement and Fairness Act (SBREFA), that create obligations for the agencies in establishing rulemaking and give the Congress on oversight role before major rules can go into effect

I believe this is an appropriate role for the Congress to play, and I think that is one reason that we are having this debate today. However, I do not believe the Congress should try to inject false arguments into the debate when the Clean Air Act is very specific—rules are to be promulgated following health based standards, which are to be reviewed at least every 5 years. In this case, the statute has been backed up by the courts regarding standards for particulate matter.

The regulatory impact analysis prepared by the EPA attempts to quantify benefits that sometime cannot be quantified, yet the estimated benefits far outweigh the overall costs. The Federal Register notice on the proposed rule states clearly that the regulatory impact analysis for the rules "will be available at the time the implementation strategy is proposed." I fully expect the analysis to be available and comprehensive when the final rule is issued.

The EPA has focused on health and the primary standard. I have come to the realization that the secondary standard, welfare, might provide significant additional benefits if those were quantified. Regardless, efforts to meet the primary standard also will benefit the welfare of Americans.

As you know, vegetation is harmed by ozone exposure. Unlike most susceptible human populations, it has few means of staying indoors. Agriculture and tourism continue to be the major economic indicators for many districts in this country represented by members of this committee. I am disappointed to see the agricultural community oppose the rule because increased incidences of high ozone exposure have reduced some crop outputs by more than 10 percent. Indeed, CASAC unanimously recommended that EPA adopt a secondary standard for ozone more stringent than the primary standard.

In addition, forest ecosystems from the southern Appalachians to the northern Adirondacks are threatened by high levels of ozone. Many States promote their natural areas for tourism, yet these beautiful mountains so far removed from urban settings are threatened by the precursors of ozone and the resulting "burn" that occurs at higher elevations.

The benefits of protecting agricultural production (including timber) and tourism economies will be well worth modifying emissions standards for all the communities that depend upon these natural resources to support their economies. These impacts and benefits must be considered in any discussion of costs.

I also would like to submit for the record, with the chairman's approval, the recent findings of the Northeast States for Coordinated Air Use Management. These findings back up the need for more stringent ozone standards.

In the case of standards for particulate matter, I believe the benefits will be substantial. I find it distasteful to try to quantify the value of a life, let alone trying to do it for 15,000 individuals. The premature death caused by particulate matter and the debate surrounding the impacts reminds me of the debate about cigarette smoke. Scientist after scientist testified that smoking did not cause lung cancer and that epidemiological tests could not show causality. Just as we reached a clear indication with cigarette smoke, the data now supports the link between particulate matter and respiratory illness.

Since the 1970's industry has tried to analyze the costs of complying with environmental regulations. I don't believe it has ever made accurate estimates.

Will there be some costs in implementing these regulations? Yes, and the EPA has made the best estimates available given the uncertainties of how the rules will be implemented at the local level.

In establishing the health based standards, EPA should not consider costs. In considering implementation strategies, EPA should and has consulted affected parties to consider costs, even before they have issued a final rule.

I will remind you of the excessive costs estimated by the utility and industrial sector during the 1990 Clean Air Act debates. We all know that those horrific scenarios did not and will not play out. Nor has the American economy gone down the tubes, if you will excuse the expression. On the contrary, technology has expanded to meet industrial demand, and States have found innovative and cooperative ways to meet attainment standards.

We may not be able to reach 100 percent attainment compliance in the next 10 years, but the effort to achieve those standards will be of value to every man, woman, and child in this country. That is a significant benefit.

In conclusion, Mr. Chairman, we have in place a regulatory system that is more scrutinized today than at any time in recent history. I believe that is a good thing. But I also believe that when agencies are following their mandates, they should be given the necessary support to implement the laws the Congress has passed.

That concludes my testimony. Thank you again for the opportunity to participate, and I will be happy to answer any questions from members of the committee.

4-24-1997 3:54PM FROM AIR*RESOURCES 6032711381 P. 1

Ken C.

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
6 Hazen Drive, P.O. Box 95, Concord, NH 03302-0095
603-271-3503 FAX 603-271-2867
TDD Access: Relay NH 1-800-735-2964

NHDES

March 11, 1997

Post-it® Fax Note 7671	Date	# of pages ▶ 6
To Sam Rick Reisman	From Ken Colburn	
Co./Dept. c/o Lean Billings	Co. NHDES-ARD	
Phone # 202-273-7808	Phone # 603-271-1370	
Fax #	Fax #	

U.S. Environmental Protection Agency
Air Docket (6102)
Attn: Docket # A-95-58
Waterside Mall
401 M Street, S.W.
Washington, DC 20460

Re: Proposed NAAQS for Ground-Level Ozone and Fine Particulate Matter

To Whom It May Concern:

The New Hampshire Department of Environmental Services ("DES") believes that the U.S. Environmental Protection Agency's ("EPA") newly proposed National Ambient Air Quality Standards (NAAQS) for ground-level ozone ("ozone") and fine particulate matter ("$PM_{2.5}$") are a significant step in the right scientific direction in terms of protecting public health and the environment and reducing the current prevalence of long range transport of airborne pollutants.

Health effects research clearly indicates that there are no "adequately protective" exposure threshold levels for ozone or $PM_{2.5}$. This fact has led to much confusion and disinformation about the effectiveness of the new standards. The simple and incontrovertible fact that "less ozone is better" has been obfuscated by arguments that it is technically impossible to define an "adequately protective" standard for pollutants which do not exhibit strong exposure thresholds.

A key ramification of this technical impossibility, however, is that longer exposures are better indicators of health impacts. As a result, DES welcomes EPA's proposed adoption of a longer 8-hour ozone standard over the current 1-hour peaking standard. In fact, DES believes that the new ozone standard should reflect an even longer averaging time period than 8-hours. If utilized as a primary standard, for example, the seasonal approach EPA employed in its new proposed secondary standard would provide better public health protection against chronic ozone exposure.

With regard to $PM_{2.5}$, DES believes that EPA's proposed standard will lead to significant public health improvements and substantial reductions in acid rain, regional haze, and nitrogen deposition into lakes and estuaries. Health studies clearly demonstrate that the smallest airborne particles migrate most deeply into the human respiratory system and cause or exacerbate respiratory disease. Regrettably, some special interests imagine that causality without epidemiology is not causality. Had this approach been employed, however, no warning from the Surgeon General about the health risks of smoking would have been published until 1996. Lives were saved by the Surgeon General's causality-based warning; lives will similarly be saved by a lower $PM_{2.5}$ standard.

AIR RESOURCES DIV.
64 No. Main Street
Caler Box 2033
Concord, N.H. 03302-2033
Tel. 603-271-1370
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WASTE MANAGEMENT DIV.
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WATER RESOURCES DIV.
64 No. Main Street
P.O. Box 2008
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Tel. 603-271-3406
Fax 603-271-6588

WATER SUPPLY & POLLUTION CONTROL DIV.
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DES is fully cognizant that the proposed ozone and $PM_{2.5}$ standards may result in significant implementation costs. Cost is a crucial component in determining how and when a proper goal is reached, but it is not appropriate in determining whether or not the goal is a proper one. Although New Hampshire has several significant concerns about the planned interim implementation of the new NAAQS, New Hampshire does not dispute their underlying propriety or integrity.

Regarding these concerns, it appears that EPA's proposed Interim Implementation Policy (IIP) for the new standards will perpetuate - perhaps indefinitely for practical purposes - the injustice between upwind sources and downwind recipients of air pollutants that has become institutionalized in federal air policy. Change on this score is long overdue, and status quo policies - which require only status quo behaviors from upwind sources - can no longer be tolerated. Toward this end, DES asks EPA to thoroughly re-evaluate its IIP, and to adopt a much more balanced, effective implementation strategy for the new standards than is currently planned. Further, as EPA is well aware, adequate federal resources are essential to the construction and operation of monitoring systems associated with the new NAAQS. Federal resources are also required to ensure that adequate technical analysis of monitored data is conducted - including speciation - so that source responsibility can be best understood and resulting control strategies optimized.

DES applauds the courage which EPA has demonstrated in proposing new, more protective NAAQS for ozone and $PM_{2.5}$. DES urges EPA to exhibit similar valiancy in addressing the implementation of these standards. Please let me know if New Hampshire can be of further assistance in this quest.

Sincerely,

Robert W. Varney
Commissioner

cc: Governor Jeanne Shaheen
Sen. Bob Smith
Sen. Judd Gregg
Rep. Charlie Bass
Rep. John Sununu

New Hampshire Clean Air Strategy Advisory Committee

NHCASAC is a joint public-private group formed to address air issues and their impact on public health and the environment.

Coordinating Agency:
N.H. Department of Environmental Services

American Automobile Association

American Lung Association of N.H.

Appalachian Mountain Club

Audubon Society of N.H.

Baldwin & de Séve

Bellwether Solutions

Business & Industry Association of N.H.

MIT, Energy Laboratory

N.H. Air Resources Council

N.H. Comparative Risk Project

N.H. Department of Economic Development

N.H. Department of Transportation

N.H. Division of Public Health

N.H. Governor's Office of Energy & Community Services

New Hampshire Legislature

N.H. Motor Transport Assoc.

N.H. Public Utilities Commission

UNH, Complex Systems Research Center

March 11, 1997

The Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, DC 20460

Re: Comments on Proposed NAAQS for Ground-Level Ozone and Fine Particulate Matter

Dear Ms. Browner:

New Hampshire's Clean Air Strategy Advisory Committee (Advisory Committee) has reviewed the proposed National Ambient Air Quality Standards (NAAQS) for ground-level ozone (ozone) and fine particulate matter ($PM_{2.5}$). The Advisory Committee is a joint public-private group consisting of representatives from business and industry, environmental and health groups, state agencies (including DES), state legislators, and others. The group was convened in August 1996 to update the first edition of the *New Hampshire Clean Air Strategy* (published in 1994) and to address other important air concerns regarding public health and the environment. The comments expressed in this letter attempt to reflect a consensus of the group. Individual members of the Advisory Committee may also be submitting comments that reflect their own perspective.

The Advisory Committee supports the U.S. Environmental Protection Agency's (EPA) newly proposed NAAQS for ozone and fine particulate matter ($PM_{2.5}$) as a positive step forward in terms of protecting public health and the environment. The Advisory Committee commends EPA for basing the proposed new standards on the best available health and scientific data.

Briefly with regard to ozone, the Advisory Committee believes EPA is moving in the right direction to protect public health with its proposed 8-hour primary standard. Health effects studies used by EPA indicate that there may be no absolute exposure threshold level for ozone that guarantees absolute health protection for the entire population. While this creates a dilemma for setting a health-protective standard, it also reinforces the simple and indisputable fact that "less ozone is better."

With regard to $PM_{2.5}$, the Advisory Committee believes that on a nationwide basis, EPA's proposed standard will lead to significant public health improvements and substantial reductions in acid rain, regional haze, and nitrogen deposition into lakes and estuaries. Health studies relied on by EPA demonstrate that the smallest airborne particles migrate most deeply into the human respiratory system and cause or exacerbate respiratory disease. Studies also show that a potentially significant proportion of all airborne fine particulates in the Northeast are sulfates and nitrates of anthropogenic origin and are major causes of acid rain, regional haze, and nitrogen deposition.

The Advisory Committee is concerned, however, that despite its downwind location, New Hampshire could continue to bear the brunt of reduction responsibilities while upwind jurisdictions - the source of much of the ozone and PM problems - could continue to evade similar measures. New Hampshire will continue to do its fair share to reduce its emissions, but if upwind sources do not do their fair share, attainment will be impossible for New Hampshire. The Advisory Committee asks EPA to ensure that this unacceptable circumstance of the current regulatory scheme is not perpetuated for several more years before being resolved. To this end, the Advisory Committee strongly supports rapid implementation of $PM_{2.5}$ monitoring and associated speciated monitoring and enhanced ground-level ozone monitoring to ensure that a balanced and fair implementation strategy is achieved.

The Advisory Committee urges EPA to address the implementation of these standards by ensuring that any and all implementation requirements achieve better health and environmental results through fair, reasonable, flexible and cost-effective measures. Please let us know if the Clean Air Strategy Advisory Committee can be of further assistance in this effort.

Sincerely,

Henry Veilleux

Henry Veilleux, VP
Business & Industry Association of N.H.

L. Bruce Hill, Senior Staff Scientist
Appalachian Mountain Club

cc: Governor Jeanne Shaheen
Senator Bob Smith
Senator Judd Gregg
Representative Charlie Bass
Representative John Sununu
Commissioner Robert W. Varney
John DeVillars, EPA Region I Administrator
Clean Air Strategy Advisory Committee
Air and Radiation Docket and Information Center
Attn: Docket Number A-95-58
Attn: Docket Number A-95-54

New Hampshire Clean Air Strategy Advisory Committee

NHCASAC is a joint public-private group formed to address air issues and their impact on public health and the environment.

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Baldwin & de Séve

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N.H. Division of Public Health

N.H. Governor's Office of Energy & Community Services

New Hampshire Legislature

N.H. Motor Transport Assoc.

N.H. Public Utilities Commission

UNH, Complex Systems Research Center

PRESS RELEASE

For Further Information:
Henry Veilleux, Business and Industry Association of NH, 603-224-5388
L. Bruce Hill, Appalachian Mountain Club, 603-466-2721 ext.111

March 13, 1997

Business and Environmental Groups Hail EPA Smog Standards

Concord, NH--An unusual and unprecedented alliance among business and environmental groups today praised Environmental Protection Agency Administrator Carol Browner's proposal to tighten air quality standards for smog. According to a March 11 letter released today (see attached), the New Hampshire Clean Air Strategy Advisory Committee hailed the new standards for ground level ozone and particulate matter air pollution as a positive step toward protecting public health and the environment. The letter also praised EPA "for basing the proposed new standards on the best available health and scientific data." The public comment period on EPA's proposal closed yesterday.

Convened in 1996 by NH Department of Environmental Services Commissioner Robert W. Varney to assist in updating the State's Clean Air Strategy, the Advisory Committee is a joint public-private group consisting of representatives from business and industry, environmental and health groups, state agencies, state legislators, and others.

The State of New Hampshire has been a leader in bringing various groups together to address environmental issues. Governor Jeanne Shaheen noted that, "The New Hampshire Clean Air Strategy Advisory Committee's support for air quality standards provides further proof that in New Hampshire, industry, environmentalists and state government can work together to protect the environment."

In expressing his appreciation for the Advisory Committee's comments to EPA, Commissioner Varney focused upon the unique balance of interests represented on the committee. "The fact that such a diverse group has reached a consensus opinion in support of the proposed standards should lend a great deal of credence to the committee's position, one that will no doubt be heavily weighed in EPA's deliberations." Varney said that EPA expects to finalize new standards in mid July after reviewing all comments.

Committee member Dr. Bruce Hill, a scientist with the Appalachian Mountain Club (AMC) said, "AMC has recorded a decade of air pollution data from atop Mount Washington that demonstrates that even remote wilderness areas are impacted by these pollutants. The groups represented in this letter are acknowledging the importance of the standards in improving air quality in the downwind states and the sound science they are based on."

While endorsing EPA's proposed standards, the letter, however, expresses concerns that despite its location downwind of many pollution sources, New Hampshire could continue to bear the brunt of reduction responsibilities, while upwind jurisdictions could continue to escape similar regulation.

"New Hampshire will continue to do its fair share to reduce its emissions," said Henry Veilleux, of the Business and Industry Association of New Hampshire which represents over 400 businesses in NH, "but if upwind sources do not do theirs, attainment of the standards will be impossible for New Hampshire. The Advisory Committee is asking EPA to address the implementation of these standards by ensuring that any and all requirements achieve better health and environmental results through fair, reasonable, flexible and cost-effective measures."

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PREPARED STATEMENT OF JOHN SELPH, TULSA COUNTY COMMISSIONER, OKLAHOMA

Mr. Chairman and Members of the Committee, my name is John Selph. I am a member of the Board of Directors of the National Association of Regional Councils (NARC) and I chair NARC's Air Quality Task Force. I am chairman-elect of the Indian Nations Council of Governments (INCOG), the Metropolitan Planning Organization for the Tulsa area, and I chair INCOG's Air Quality Committee.

On behalf of NARC, I appreciate your invitation to testify before the Subcommittee regarding the U.S. Environmental Protection Agency's (EPA) proposed changes to the Clean Air Standards. The National Association of Regional Councils represents some 300+ councils of government consisting of cities, towns and counties in metropolitan and rural areas from throughout the United States. These regions run the gamut from areas in severe non-attainment to regions that have always been in attainment. My comments reflect the policy positions developed by NARC. My comments also draw from my experience as a County Commissioner in Tulsa, Oklahoma and my academic background, which includes a Masters Degree in Public Health with an emphasis in Environmental Sciences.

Before I discuss EPA's proposed standards, let me tell you a little about Tulsa and our experience with air quality. Tulsa County was a non-attainment area until 1990. We worked very hard locally to achieve attainment status, and our county achieved attainment status prior to the signing of the Clean Air Act Amendments in November, 1990.

It was very important for us to avoid the stigma associated with being on the EPA non-attainment list, especially for economic development purposes. Since that time, we have worked even harder to maintain our clean air status. While our efforts have been wide-ranging, perhaps most notable was the creation of the nationally recognized Ozone Alert! Program, the nation's first voluntary episodic emissions control program. This program reflects our philosophy of seeking voluntary, common sense measures that are most effective in improving air quality, rather than the command and control approach too often used by the State and Federal regulators.

Let me also say that both NARC and I recognize the importance of improving air quality, and we support actions to maintain and improve the health of all citizens when such actions are based on sound scientific and economic principles. In light of this, we are especially concerned about the conflicting opinions of the scientific community regarding the scientific basis for establishing new Ozone and Particulate Matter standards. There appears to be no scientific consensus that changing the standards at this time will result in significant public health benefits. Indeed, the scientific testimony presented previously to this committee, and the recently revised EPA exposure and risk assessment fundings, underscore this lack of consensus.

EPA has stated that the proposed changes are policy-based rather than science-based. EPA also has stated that it believes existing clean air law requires that its analysis of the impact of the changes be based solely on the health aspects, and that adverse economic consequences that may result from the changes may not be considered in setting the standard. In light of these concerns, we feel that considerable additional research, including additional epidemiological studies, are necessary before new ozone and particulate matter standards are promulgated. Specifically, future epidemiological studies should focus on the interaction between different pollutants and whether these effects are additive, synergistic or antagonistic.

The Clean Air Act has clearly had a demonstrable impact on reducing pollutants, thus improving air quality for all Americans. If EPA imposes its proposed ozone standards, the number of non-attainment regions nationally will increase, by EPA's own estimates, from 68 areas currently to 185 areas—nearly a threefold increase. EPA's action of designating additional areas as non-attainment will do nothing to improve air quality in our most polluted regions. In fact, these existing non-attainment regions are having great difficulty in achieving the current standards, so forcing a mid-course change at this time will only delay and disrupt both public and private initiatives designed to achieve the objectives of the Clean Air Act. Furthermore, we are not convinced that the technology is in place, or even close at hand, to help us meet these proposed standards.

With regard to the Proposed $PM_{2.5}$ standards, we believe that EPA lacks sufficient scientific evidence to justify revising the existing Particulate Matter standard. Although the scientific evidence does suggest some preliminary correlation of health effects, it is as of yet inconclusive. The current studies have not clearly defined public health effects from fine particles well below the existing standard. Additionally, the significant uncertainty and limited research regarding ambient concentrations of $PM_{2.5}$ due to the limited number of ambient air monitors in place support our concerns about the addition of this standard. We feel that in light of these concerns, which were substantiated at previous subcommittee hearings, considerable further

study is necessary before an additional particulate matter standard is promulgated. To this end, we are pleased to note that EPA has requested $28.4 million for particulate matter research.

Our experience in Tulsa has shown us that the goal of improving air quality is both worthy and attainable if approached in a common sense manner. In addition to our Ozone Alert! Program, Tulsa, by formal agreement with EPA and a host of other Federal, State and local partners, has become the nation's first Flexible Attainment Region (FAR). The FAR agreement enables us to implement a locally crafted strategy to reduce emissions, and gives us adequate time to evaluate results before having to implement more stringent measures to meet our goals. This avoids the "one size fits all" command and control approach which historically has been imposed by EPA. The FAR agreement came about because our local governments and private industry are committed to working together to improve air quality. The necessary ingredients to make this initiative work are flexibility and common sense. When we are allowed to develop our own program and local "buy-in" is assured, the willingness to commit the necessary financial and political capital to achieve results is more readily accepted.

Recently, one of our refineries in Tulsa was the subject of an EPA enforcement action. The refinery, as part of its penalty, proposed to reduce the Reid Vapor Pressure (RVP) of its gasoline to 8.0 psi and pay a significant financial payment to EPA. Refineries and pipeline companies in the Tulsa area voluntarily reduce the RVP of their gasoline to 8.2 psi during the ozone season. The Federal mandated level is 9.0 psi. We are told that the initial reaction of EPA was to reject the proposal and to require the refinery to identify another project to undertake as a Supplemental Environmental Project. The net effect on the Tulsa area would have been a net reduction measured in pounds of emissions rather than the tons needed to maintain our attainment status. We expressed our concern to EPA and, thankfully, common sense prevailed. We understand that the agency has reversed its position, has accepted the 8.0 psi RVP, and has also directed that part of the fine go to the Tulsa area to finance free bus rides during the upcoming ozone season. We think this action by EPA will give us a significant boost in meeting our air quality goals. The action makes sense—a violation is enforced, and citizens—rather than just the U.S. Treasury will directly benefit.

In essence, improving air quality can be achieved without severely disrupting the economy, and without increasing unfunded mandates. The imposition of standards, which even EPA states may be unachievable, will severely dampen the enthusiasm needed to maintain the momentum for improvement. Moreover, in the current ISTEA reauthorization debate there is discussion about eliminating the Congestion Mitigation and Air Quality Program. Without the CMAQ program, we would end up losing an important tool necessary to meet the long range goals of improved air quality. I would like to point out, however, that the current ISTEA legislation does not provide for areas that are in attainment, like Tulsa, to receive CMAQ funds to undertake air quality improvement programs. We would recommend that consideration be given to expanding the eligibility for receiving CMAQ funds to those areas that are in attainment that have a formal program in place designed to reduce emissions. An ounce of prevention is worth a pound of cure.

In conclusion, Mr. Chairman, we believe that more thought and study must be accomplished before the standards are changed. The potential impact is great, and we must have more certainty and consensus before a major change, such as this, is initiated. Progress is being made in improving air quality and more will come if common sense and flexibility prevail.

I appreciate being invited to participate in the Subcommittee's hearings. On behalf of NARC, we look forward to working with the committee in your important task.

Thank you for the opportunity to testify today. I respectfully request that my full statement be made a part of the official hearing record; and I will be happy to answer any questions you may have.

PREPARED STATEMENT OF ROBERT C. JUNK, JR., PRESIDENT, PENNSYLVANIA FARMERS UNION

Good morning, Mr. Chairman and members of the committee. My name is Robert Junk. I am president of the Pennsylvania Farmers Union. I am also a member of the board of directors of the National Farmers Union and appear here today on behalf of NFU.

The National Farmers Union, a general agricultural organization representing 300,000 family farmers and ranchers, takes this opportunity to comment on the proposed changes to air-quality standards for ozone and particulate matter (PM).

The National Farmers Union has a long history of supporting conservation programs, because the family farmers, as stewards of the land, are concerned about the environment. Significant levels of emissions are already controlled because farmers and ranchers are using good soil and water conservation practices and are keeping their equipment in good operating condition. It is simply in their best interest to do so because they seek to preserve the land to pass on to future generations.

National Farmers Union is concerned that the proposed changes to the air-quality standards for fine PM and ozone will greatly increase the regulation of farm operations and increase costs to farmers both directly and indirectly. We are additionally concerned that there is currently no funding in place to offset these costs other than what the farmer will be required to pay.

The costs of the proposed standards for ozone and fine particulate matter will fall heavily on individuals and State and local governments. Farmers, along with other other U.S. taxpayers, will pay for the new rules in many ways—through higher local and State taxes or through cuts in important State and local programs and services, including police and fire protection, education, help for the poor and homeless and other public programs. In a joint letter to the Environmental Protection Agency (EPA) Administrator Carol Browner, the National League of Cities, the Conference of Mayors, the National Governors' Association, the National League of Counties, the National Conference of State Legislators, and other State and local organizations said the "proposed new standards would have an enormous impact . . . on the ability of State and local officials to meet other urgent priorities."

The new rules will change the way people live. The changes will range from the serious and expensive (higher State and local taxes and cuts in programs and services) to the moderately expensive (higher costs for things like electricity, cars and gasoline) to the aggravating and inconvenient (driving restrictions, increased automobile inspection and maintenance programs and mandatory car pooling).

State and local official are not the only ones criticizing EPA's proposals. Criticism of the proposals are widespread within the Clinton Administration—a fact which EPA did not disclose to the public. A number of Federal agencies, including the Treasury Department, the Office of Science and Technology, the Department of Commerce, the Department of Transportation, and the Small Business Administration, all said in documents just made public that the new standards are not justified. Another agency, the President's Council of Economic Advisors, said the EPA's estimates of the cost of the new rules—a combined $8.5 billion, according to the EPA—is considerably off the mark. According the council's estimates, the cost of the ozone standards alone will be $60 billion a year.

How can we justify increased standards for air-quality in rural America when the Conservation Reserve Program is now facing significant funding reductions? To improve the quality of our air, we should increase funding for these conservation programs rather than impose more regulations on farmers. In order to meet new standards, according to a report of the State and Territory Air Pollution Program Administrators and the Association of Local Air Pollution Control Offices (STAPPA/ALAPCO), the agricultural sector may face tighter operational and processing controls to reduce particulate matter emission. STAPPA/ALAPCO's proposed particulate emission control options for agriculture include:

- Wind breaks—and other residue management systems to reduce wind erosion.
- Conservation tillage—use of special equipment to avoid mixing in residues.
- Crop management—planting of legumes of grasses to build soils, grassed waterways.
- Cover crops—planting alfalfa and winter wheat to protect vegetation.
- Dust controls for storage areas—tarps, covers.
- Grain elevators—cyclones, fabric filters, vents application of oils to grain to control dust.
- Grain Transportation—covers on conveyer belts, bucket elevators, etc.
- Feed mills—moisture control measures and cleaning

The U.S. Department of Agriculture and the Small Business Administration questioned the EPA's proposed standards on PM and charged that the new standards "are not based on adequate scientific evidence" and would have a "large economic impact" on "tens of thousands, if not hundreds of thousands of small businesses" and farms. USDA further claimed that "it is premature for the EPA to change the existing standard until scientific evidence is correctly obtained and interpreted." USDA also noted the concerns held by farm groups that the new standards "may impose significant costs" on farmers, particularly the 71 percent of U.S. farms with annual sales of less than $40,000. The documents also suggest that the proposed

regulations may drive up farming costs such as fuel, fertilizers, pesticides, and necessary chemicals.

When farmland regulations of this kind are determined, EPA and other government agencies should take into account the contribution of agricultural lands to improved air quality. Despite the fact that agriculture is not a major emitter of PM, the standards proposed by EPA would lead local and State governments to tighten regulation on farm operations. Because it is difficult to measure accurately the amount of fine particulate matter in the air, it is likely that under the new rules, arbitrary limits on what a farmer can till soil, harvest crops, or apply fertilizer could become an unfortunate reality. Although rural areas generally record low levels of pollution, these same areas could soon be in violation of the stricter standards if these proposed rules become law.

Because the proposed standards would stiffen the regulations of particulate matter, the impact of the new regulations would be significant to farmers. Fuel and energy costs are the third largest non-agricultural input supply expense for American farmers, and under the proposed rules farmers will be required to pay even more for transportation costs. Furthermore, Federal, State or local regulators could decide that rural roads, including those on private lands, would need to be improved to meet the EPA's proposed standards, which could be very costly to farmers.

Agricultural operations have been interpreted as being a "significant source" of emission for particulate matter. Various agricultural facilities are presently being regulated in non-attainment zones primarily in the Southwest and Far West. Under the proposed $PM_{2.5}$ standards, new non-attainment zones may be proposed across the United States, potentially affecting all agricultural operations and family farms.

We urge EPA to work closely with USDA and others to ensure the availability of the best data pertaining to emissions from agricultural activities and the effects of control programs on agriculture and rural communities. National Farmers Union is concerned about the potential effects that implementing control programs, designed to help areas attain the new standard, could have on small farms. EPA defines small entities in the Regulatory Impact Analysis (RIA) as establishments with less than 100 employees. In many areas of the country, agriculture is characterized by owner-operator firms that typically employ few, if any, hired workers.

USDA's most recent data show that 71 percent of U.S. farms have annual sales of less than $40,000, while fewer than 6 percent have annual sales greater than $250,000. In 1994 and 1995, farmers spent about $170 billion on farm inputs and services. Both direct and indirect energy inputs account for about 22 percent of the total expenditures for agricultural production, according to USDA. However, direct and indirect energy account for a considerable higher percentage of farmers and variable expenses. With energy constituting a high percentage of variable expenses for many major crops and for livestock, farmers are sensitive to changes in variable expenses because production decisions are based on the prices of variable inputs. Production and/or use of many of these inputs could be affected by emission control programs, including fuel that powers farm equipment, electricity, fertilizers, pesticides, and other agricultural chemicals. Because a large proportion of farms are small entities, increased costs for farm inputs would surely have a negative impact on their financial performance.

We are also concerned that existing equipment on farms will be required to be altered to adhere to the new standard, resulting in significant expense to farmers during EPA review; we consider it to be an important time to define what equipment is considered "old" or "new". Until now, we have been unable to determine a clear definition of these terms for farm machinery. Examples of PM emissions from agriculture include dust from cultivation and harvesting, wind-blown dust from feedlots, grain elevators and grain mills, and diesel soot. Emission of PM also include PM precursors such as ammonia, which rises from feedlots and dairies, diesel emissions, nitrogen oxides and sulfur dioxides from industrial boilers, soot from fires and spray drift from crop protection products.

National Farmers Union is concerned about the characterization of pollution in particular air sheds. Where does the pollution come from, and what activity caused it? What percentage of the total pollution inventory results from an activity? Are there cost-effective control strategies that reduce pollution while maintaining productivity? We believe a well coordinated research program with Federal, State and local participation is necessary in order to begin answering these questions. Without answers, controls could be costly and ineffective.

In the spirit of cooperation, we believe it is imperative that USDA develop a specific Memorandum of Understanding (MOU) with EPA to transfer technical expertise and support for those air-quality issues derived by the Clean Air Act Scientific Advisory Committee which significantly involve or affect the agricultural industry. Agricultural scientists possess the knowledge to provide this expertise which will

maintain USDA confidence and integrity among the agricultural industry producers. This must be a serious and outgoing commitment by USDA to provide this avenue of knowledge, research, development, and technology transfer.

We found that many current, agricultural air-quality issues require additional understanding and knowledge well beyond that which exists today. Examples are the unknowns about particulars emitted by wind-blown dust, field operations and nonroad-engine emissions. We would recommend you consider a departmental air-quality research initiative to provide the level of understanding of the environmental impacts this issue demands, in the same way in which we addressed water quality issues in recent years that is cooperatively handled by several agencies.

We believe agricultural producers will continue to implement many of the air-control measures to benefit our environment. It is imperative that farmers be provided the knowledge and flexibility to design and voluntarily apply air-quality controls locally. Each area of the country faces different air-quality challenges. We urge you to encourage increased cooperation with EPA scientists, USDA officials, agricultural producers and others to arrive at control strategies that work. For example, some EPA regulations require a reduction in agricultural burning. However, the conservation practice "Prescribed Burning" which has proven to be an effective tool for some selected production systems to control pest and diseases. This method does not applicable in every case; therefore it is critical to have locally led efforts to achieve conservation goals.

In conclusion, before more research can be completed to determine exactly how much $PM_{2.5}$ is emitted on farm operations, we strongly urge that no changes are made to current standards. As the control measures required under the Clean Air Act continue to be met, further reductions in particulate and ozone emissions will continue to decrease, and air-quality will continue to improve. We support the conservation practices and other measures taken as part of the Clean Air Act, and we look forward to continuing to work with you on this important matter.

EXCERPTS FROM ARTICLE V OF NATIONAL FARMERS UNION 1997 POLICY MANUAL SECTION

O. Conservation

We support the development of a one-stop conservation planning system for agriculture through the Natural Resources Conservation Service (NRCS). A single conservation plan jointly developed by the farm operator and the NRCS should be established to fulfill the requirements for the current maze of land and water regulations of various governmental agencies.

Conservation programs should be good for the environment, reward stewardship of land and water resources, discourage speculative development of fragile land resources, strengthen family farming and enhance rural communities.

The objective of the conservation plan must be to reduce and control wind and water erosion, prevent non-point pollution, and enhance the soil and water capacities of the land.

The plan should designate which highly erodible soils should not be tilled and which may be tilled with approved conservation practices. It should clearly map and document both existing and drained wetlands, as well as any drains and channels. The plan should outline the conservation of wetlands, as well as the maintenance of drains and channels. It should also provide for meeting soil erosion goals and controlling non-point pollution.

Such a conservation planning system should replace the existing sodbuster, swampbuster, Corps of Engineers flood-plain and other regulations which impact agricultural lands. The plan should be supervised and approved by the USDA committee process, with the technical assistance of the NRCS.

Once the plan is filed with NRCS and implemented, a producer should be deemed to be in compliance with all Federal agencies. Producers should be allowed to remedy inadvertent or unavoidable failures to carry out conservation plan practices, and penalties should be based on the degree of the violation. Loss of full Federal farm program benefits should be imposed only in cases of purposeful destruction of conservation practices. Current conservation compliance requirements allow too few options to account for local involvement, climatic conditions, and geography, which are beyond producer control.

1. Government Programs

Government conservation programs should be funded at levels that will ensure the continued protection of our nation's soil and water resources. Such financing should be on a long-term basis, providing Federal commitments for at least 5 years ahead and providing conservation assistance on a level designed to meet the needs

as shown in the Federal land conservation inventory and the appraisals under the Resource Conservation and Recovery Act of 1976 and other Federal studies.

The needs are so widespread and urgent that any "targeted conservation" program would, if it were motivated by something more than budget savings, have to call for a vast expansion of Federal conservation investment. We request that Federal financing to meet clean water and air standards of the Environmental Protection Agency (EPA) be available to farmers from funds appropriated by Congress for this purpose, and that such funds be administered through the farmer-elected committees.

We urge continued improvement and acceleration of the small watershed programs.

We support the continuation and expansion of the Environmental Quality Incentives Program which includes, the Agricultural Conservation Program (ACP), Water Quality Incentives Program, Great Plains Conservation Program, the Colorado River Basin Salinity Control Program, and other soil and water programs, and we urge full appropriation of funding directed to family farmers and ranchers.

We urge that ACP be funded at not less than the $500-million level as originally authorized by the Soil Conservation and Domestic Allotment Act of 1937, and we strongly urge that the conservation cost-sharing delivery system for all rural Federal conservation cost-sharing funds be through the farmer-elected committee system.

Farmers should be able to put strips into grass for soil conservation purposes and use these strips year after year for diverting and conserving without losing base.

2. Agricultural Resources Conservation Program

We support the Environmental Conservation Acreage Reduction Program (ECARP). We urge full funding of the three branches of ECARP—the Conservation Reserve Program (CRP), the Wetlands Reserve Program, and the Water Quality Incentives Program—to ensure proper implementation.

We also support greater emphasis on improved farm management techniques. Teaching farmers to be the best possible stewards of their resources is a better long-term approach to sustainability than simple land retirement.

We recommend that the payments due to cooperating farmers in ECARP be in cash, rather than in certificates or CCC commodities.

We support the 25-percent-per-county acreage limit for ECARP.

The CRP program needs to be closely monitored by the Natural Resources Conservation Service (NRCS) and the Farm Service Agency (FSA) with enough funding to enforce contract requirements for adequate weed, insect, and fire control. Enrollees should be allowed to manage permanent vegetative cover to enhance wildlife habitat and ecosystem health.

In extending the Conservation Reserve Program and CRP contracts, we recommend that the program be better focused to serve the needs of family farmers and ranchers and to protect highly erodible land (HEL) and other environmentally sensitive lands.

CRP lands which can qualify for the Wetlands Reserve or Water Quality Incentive programs should be extended and transferred to those programs through voluntary participation.

All CRP lands currently enrolled in the program should be re-evaluated for contract. The most environmentally sensitive land should be given first opportunity for contract.

CRP lands diverted into long-term timber and forestry conservation projects should be given a high priority for contract re-enrollment. We recommend that planting property to shelterbelts or other conservation measures be encouraged through reduced property taxes on those acres. We recommend that producers who destroy shelterbelts or wooded areas establish the same number of acres of new trees for a minimum of 10 years.

We favor CRP contracts and contract extensions for periods of not less than 10 years. We favor programs which maintain CRP lands in private ownership in the hands of resident family farm and ranch operators.

Incentives to aid beginning farm and ranch families should be offered on land that was previously enrolled in CRP, but is not environmentally sensitive under the new rules and will not be re-enrolled.

We urge that financial and technical assistance be provided to producers in preparing CRP acreages for sustainable agricultural systems that will meet established conservation standards. In addition, land managed with appropriate organic standards while enrolled in CRP should be eligible for organic certification upon leaving the program.

In times of extended drought conditions or other weather disasters, haying or grazing on CRP acres should be allocated to all livestock producers based on need. The FSA farmer-elected county committees should be given authority to set the date of harvest, based on the nutritional value of hay. These regulations should be in place so the procedures are known in advance. The maximum landowner income from the haying and grazing should not exceed the annual CRP contract amount from that farm.

3. Sodbuster and Swampbuster Provisions

We support provisions which give the secretary greater authority in handling sodbuster and swampbuster violations.

The goal of soil conservation practices should be to reduce soil losses to tolerable levels, or "T-levels." We recommend that alternative conservation systems be used only in cases of financial hardship, after recommendation of local conservation officials.

We call upon Congress to designate the FSA as the single agency to regulate swampbuster provisions.

4. Wetlands

Wetlands deserve protection in order to preserve harmony with the nation's land and its resources and natural systems on which all life depend.

Requiring re-certification of wetlands at 5-year intervals creates a moving target for producers in their compliance efforts. While we support a single, coordinated approach to wetlands protection, we believe that producers must be provided full opportunity to participate in the development and review of such joint regulation. We reaffirm our support for making the NRCS and FSA the lead agencies in wetlands delineations on agricultural land.

We support the joint efforts of these agencies to propose a single set of definitions and rules in the proposed revisions to the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands, which are pending release. However, the proposed manual's exemption of the prairie pothole region of the United States from its coverage leaves many farmers with no chance for an improvement in wetlands procedures. This critical error must be corrected in the final manual, since commodity production and farm survival are at stake.

In addition, we recommend:

(1) that any and all wetlands determinations throughout the United States rely on the presence of all three of the following mandatory wetland criteria simultaneously appearing on the same site year-round: (a) hydrology; (b) a predominance of hydric soil; and (c) a prevalence of hydrophilic vegetation;

(2) that all existing wetland determinations be reevaluated under the proposed manual's uniform definitions and procedures with the elimination of buffer zones;

(3) that the Federal Government consult with State and local governments to develop a unified, mutually agreeable management program to protect our nation's wetlands;

(4) that a wetlands management program balance wetland values and the needs of the various States and their political subdivisions and individual property rights;

(5) that any leaseholder, renter, or owner be compensated equitably for the taking of any lands through the classification of wetlands;

(6) that for the protection and preservation of our natural resources as well as our human resources and our free-enterprise system and democratic way of life, the final interagency manual be revised with greater consideration for the food and fiber producers of the United States;

(7) that regulations ought to be amended to allow farmers to mitigate wetlands in a given acreage, provided that there is no net loss of wetlands in that acreage; and

(8) that Congress study the impact of current and any new wetlands proposals on agricultural producers, family timber operations, and rural communities and give careful consideration in identifying and separately regulating any artificially created wetlands. Induced wetlands should be exempt from wetland restrictions.

5. Predator and Rodent Control

Since the 1931 Animal Damage Control Act (ADC) mandates that the Federal Government protect the livestock industry from predatory loss, we recommend that the original intent of the law be enforced.

Judicious use of control practices must be continued on Federal, State, and private lands to control coyotes and other predators.

To the extent that an adequate ADC program is not available to farmers, we recommend that a federally financed indemnity program be instituted to pay for livestock losses.

PREPARED STATEMENT OF BOB VICE, PRESIDENT, CALIFORNIA FARM BUREAU FEDERATION, ON BEHALF OF THE AMERICAN FARM BUREAU FEDERATION

Thank you, Mr. Chairman, for the opportunity to provide testimony for this important hearing on air quality. I am Bob Vice. I own and operate a wholesale citrus and avocado nursery and farm avocados near Fallbrook, California. I am President of the California Farm Bureau Federation and today I am representing the American Farm Bureau Federation, the nation's largest general farm organization with more than 4.7 million member families. Our members grow every type of farm commodity found in America. I am pleased to have the opportunity to discuss with you today the impacts of new air standards on the agricultural community. My comments focus primarily on the Environmental Protection Agency's proposal to revise the National Ambient Air Quality Standard (NAAQS) for particulate matter.

As a preface to my comments, I think that it would be appropriate to share with you a portion of Farm Bureau's policy on air quality that was adopted by delegates to our annual meeting. It clearly outlines the position of America's farmers and ranchers regarding the importance of clean air. It reads, in part:

> We support a healthy environment. We support government policies that: Are based on sound scientific evidence; provide incentives to industries seeking to become more energy efficient or to reduce emissions of identifiable atmospheric pollutants; seek cooperation of organizations and governments, foreign and domestic, to develop better understanding and research on the implications of atmospheric pollution and the means of preventing it.

The evidence is quite strong that conservation has been a priority for farmers and ranchers for many years. There has been, and continues to be, a tremendous amount of conservation activity by farmers and ranchers across the country. These activities include such things as protecting wildlife habitat, creating wetlands, grassed waterways and field buffer strips. We also use conservation tillage techniques and cover crops, and plant trees and vegetation for windbreaks.

All these activities reduce wind erosion of the soil, which in turn, provides cleaner air. The Conservation Reserve Program alone will idle up to 36.4 million acres across the country that provides vegetation that stabilizes soil and prevents windblown dust. Wind erosion on 84 percent of the nation's rangeland, 86 percent of the cropland, and virtually all of the pasture land is now less than the tolerable soil loss rate—meaning, the rate at which soil erosion can occur without surpassing the natural rate of soil regeneration (which is 2–12 tons per acre per year). And soil lost to wind erosion continues to decrease as farmers expand these extremely environmentally beneficial practices (Attachment I). Farmers are cleaning the air and should get credit for those activities.

Make no mistake: we are all for clean air, and this debate today is about how to continue to achieve those goals.

Agriculture is concerned because EPA estimates that 34.3 percent of fine particulate matter can be attributed to agriculture and forestry. Regarding this questionably large estimate, I quote Dr. Calvin Parnell, a professor of Agricultural Engineering at Texas A&M University and a member of the U.S. Department of Agriculture's Task Force on Air Quality. He says, and we agree, that:

> The data used to develop this inventory was based on erroneous emission factors published by EPA for cattle feed yards, feed mills, grain elevators and dust from farmers' field operations.

Those comments were made last week in a hearing held by a subcommittee of the House Agriculture Committee. Furthermore, I quote the Honorable Larry Combest, Chairman of the House Agriculture Subcommittee on Forestry, Resource Conservation, and Research from that same hearing. He says, and we agree, that:

> The science employed in developing this rule is not up to par, and I'm concerned that farmers could bear the brunt of a bad policy based on equally bad science. We don't have the research yet to know whether we can actually attain these standards, how much it will cost the agriculture industry and the consuming public, and how much agriculture activity actually contributes to air pollution problems. (Attachment II).

We share these same concerns. We also commend and extend the comments raised by the USDA, the USDA Task Force on Air Quality and the Small Business Administration in regards to economic impacts of this standard on farms and ranches (Attachment III).

CALIFORNIA SITUATION

Today, however, I want to focus on actual situations those of us involved in California agriculture already face in regard to the present PM_{10} Non-Attainment Area for central and southern California, as determined by the 1990 Amendments to the Clean Air Act. Under this status, a major portion of California's agriculture has been faced with a number of challenges which, in many cases, are yet to be resolved. Agriculture in other areas of the country may face the same situation if a new PM standard is imposed.

The money, time and resources we have spent attempting to meet the PM_{10} ambient air quality standard have given us plenty of reasons to know that we cannot jump immediately into a new air quality standard of which we know so little about. It is an absolute necessity to allow science surrounding $PM_{2.5}$ to develop, so that intelligent, reasonable and justifiable decisions can be made.

Let me expand on one of our air district's experiences in dealing with the present PM_{10} standard. These are examples of situations agriculture has faced in the San Joaquin Valley Unified Air Pollution Control District.

Example 1

The emission inventory for agricultural tillage operations was the focus of the initial discussions with the air district. There are two major problems identified in this inventory. First, the actual number of passes the equipment makes per acre, and second, the PM_{10} emission produced from each type of operation such as disking, ripping or furrowing. This problem was due to the fact that information, published by the EPA, indicated that alfalfa was disked eight times per year, rice 13 times per year and rangeland twice per year. This greatly overestimated the emissions and made agriculture the prime target. First, farmers disc and seed alfalfa maybe only once every three or more years, not eight per year, and farmers don't even disc rice or rangeland at all, much less 13 and two times per year, respectively.

Some of the control measures suggested for agriculture operations included: sprinkler irrigation on fields prior to planting; water tanks mounted on tractors and water sprays on the back of disking equipment (without taking into account that water is of a premium in California); and the use of shaking equipment to shake trucks and farm implements prior to exiting a field or unpaved road onto a paved road (this would supposedly eliminate the carry-out of mud or dirt, which would later be entrained into the atmosphere by cars or trucks on paved roads). These irrational and impractical controls would have done little if nothing to clean the air and would have been extremely costly for California agriculture, had they not been corrected.

Just by updating the inventory with current acreage information for each crop and correcting the number of passes per acre for tillage equipment, the agricultural PM_{10} emission inventory for tillage operations was reduced 30 percent.

Example 2

At one point it was discussed that farms should be permitted by their local air districts. In the San Joaquin Valley alone, it was speculated that over 31,000 permits would need to be written for farms. Each silage pile, unpaved road and equipment storage yard, to name a few, would have been permitted. The District estimated that it would need 70 additional permitting engineers to process air quality permits just for farms.

Example 3

As I indicated, information used by the air districts identifies agriculture as a primary source of PM_{10} emissions. For the past 5 years, California's agriculture community has fought to address the deficiencies in those inventories. One example is windblown dust emissions from agricultural lands. In the original inventory, it was assumed that all farming in California was "dryland" farmed. It assumed that the land was not irrigated, and that there was no vegetation cover, or cover canopy, from the crops. Once irrigation and vegetation cover was put into the wind erosion equations, the wind erosion PM_{10} emission inventory was reduced an incredible 80 percent from 410 tons per day of PM_{10}, to 58 tons per day of PM_{10}.

Example 4

Probably the most blatant example of an inaccurate inventory,which would have cost the agricultural industry thousands of dollars, was the initial emission inventory for combustion engines used to drive irrigation pumps. The original inventory estimated nitrogen oxide (NOX) emissions (a precursor of PM) at 626 tons per day from all the pumps in the San Joaquin Valley. This would be the highest emissions category for NOX emissions in the San Joaquin Valley exceeding all the mobile

sources including all cars and trucks, which together only emit 353 tons per day. Driven by agricultural inquiries, a new study was commissioned that was based on actual interviews with 360 farmers. The new study determined that the NOX emission for these pumps is only 32 tons per day.

We have only begun to address agriculture's concerns with PM_{10} estimates, many of which are still unaddressed and uncorrected. Furthermore, other PM_{10} issues are still arising. For example, EPA is also looking at NOX and ammonia (NH3) from soils as contributors to ambient levels of PM_{10}. This could mean farmers will also have to address the application of fertilizers and pesticides as an air quality concern, not to mention livestock. Yet, recent studies performed in the Valley indicate that there are very little NOX or NH3 emissions from the soil. Questions about how much particulate matter is released into the air through natural occurrences, such as high wind or volcanoes, also remain to be addressed (Attachment Ill).

Considering all these discrepancies, it is unbelievable that we are now again faced with the same problems, only this time with smaller particulate matter. Based on the 1994 Emissions Inventory for the National Particulate Matter Study, fugitive dust emissions from agriculture have been listed as the third largest source of $PM_{2.5}$ nationwide, falling behind paved and unpaved roads. This is hard to believe, since there has never been any actual $PM_{2.5}$ emission data taken on agricultural tillage equipment using EPA approved $PM_{2.5}$ samplers. All of these examples only emphasize the necessity to fully study $PM_{2.5}$ before deadlines are set and rules are developed.

CALIFORNIA STUDY

In attempting to resolve some of the previously mentioned issues, it became necessary to conduct a multi-year, multi-faceted air quality study. Such a study was developed and is now underway in California. This study, known as the California Regional Particulate Matter Air Quality Study (CRPMAQS), will address all areas of PM_{10} and $PM_{2.5}$ issues. This includes emissions determinations and quantifications, data analyses, demonstration studies, ambient air quality measurements and model development. USDA is playing a major role in this study by helping to fund emissions studies for agricultural activities and operations. Once completed, it will be the source by which decisions on particulate matter will be made in California, and will serve to aid other areas in the Nation and the world in their particulate matter decisionmaking process.

This comprehensive study, however, will not be completed for roughly 5 years. I want to emphasize that this study is the first comprehensive study that actually measures, instead of estimating, agriculture's $PM_{2.5}$ emissions. In order to avoid the mistakes made for PM_{10}, this study and others like it must be completed before costly implementation activities, attainment deadlines and regulations are set in place for yet a new PM standard.

CONCLUSION

In conclusion, I want to reiterate that much work is yet to be done in the agriculture industry before a new standard is set for particulate matter. We must develop an accurate measurement method for $PM_{2.5}$ in order to determine and quantify the significant sources of $PM_{2.5}$ and we must complete the necessary research to understand the true nature and formation of $PM_{2.5}$, so as not to make the same mistakes that we are making with agricultural PM_{10} emissions.

A shotgun approach will only serve to put American agriculture out of competition with other countries and put agricultural producers out of work. Because U.S. agricultural commodity prices are tied to world prices, a farmer cannot simply "pass on" the cost of doing business to the consumer. In other words, "we are "price takers" and not price makers." Therefore, any increase in operational costs of farming becomes significant and must be based on accurate information that justifies the expenditures.

We also want to be careful in not tipping the balance of regulation in this country to far as to force our grocers to fill market orders with food purchased from other countries that do not always meet the same safeguards and health standards as U.S.-produced commodities.

The agriculture community enjoys breathing clean air as much as anybody, but it doesn't want to waste money on control measures that have little or no effect on cleaning up the air of this Nation.

Finally, the USDA must maintain a strong presence as discussions continue on these new standards. The USDA, the Small Business Administration and the USDA Agricultural Air Quality Task Force must continue to demand that the concerns of

America's farmers and ranchers are addressed by the EPA in order to ensure a continued safe, abundant, healthy and affordable U.S. food supply.

I end on a note of caution as expressed by Paul Johnson, Chief of the USDA's Natural Resources Conservation Service, as he remarked in last week's hearing that:

> When local air quality administrators make decisions about which pollution control programs to implement, they will consider factors such as the percentage of total pollution in the airshed that is caused by a specific activity or source, and costs and benefits of implementing a set of controls on these activities. Agriculture is practiced throughout the country using many different technologies on a variety of soils and in a variety of climates. Conditions, technology and practices, along with a number of other factors determine emissions. Agricultural emissions are highly variable within and across airsheds and must be evaluated carefully.

Thank you.

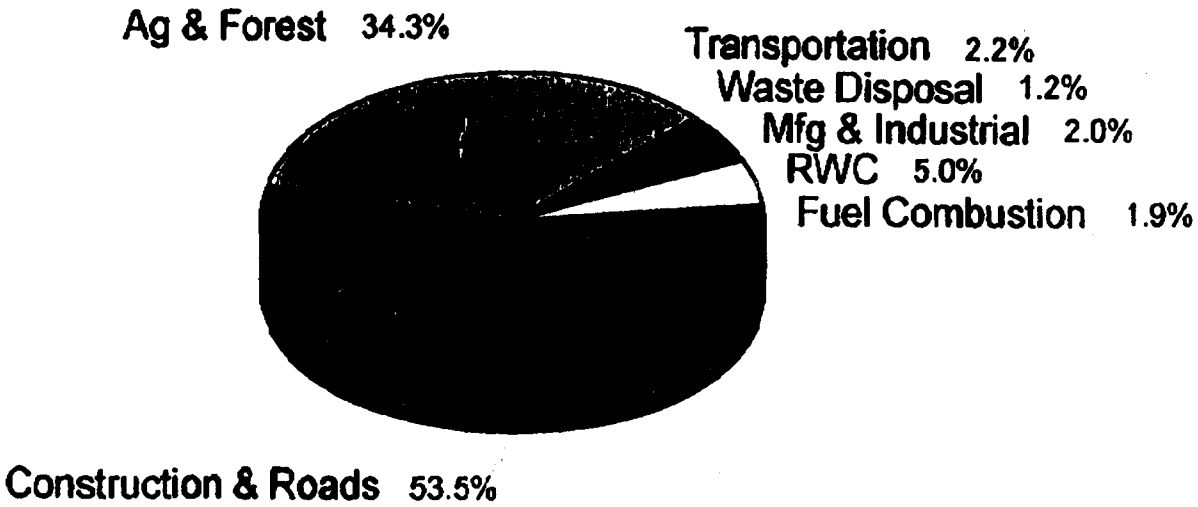
Air Quality and Agriculture Issues

Sally Shaver, Director
Air Quality Strategies
and Standards Division

March 5 and 6, 1997

PM 2.5 Anticipated Emissions

Major Categories



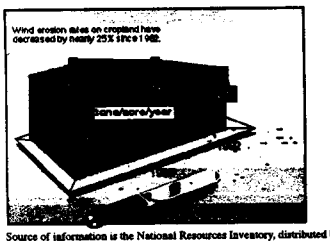
Conservation Practices Prevent Wind Erosion

- **The average annual rate of wind erosion on cropland has declined from 3.3 tons in 1982 to 2.5 tons per acre in 1992. Most of the improvement occurred between 1987 and 1992.**

- **Wind erosion on 84% of the Nation's rangeland, 86% of the cropland, and virtually all of the pastureland is less than the tolerable soil loss rate - that is, the rate at which soil erosion can occur without diminishing the soil's inherent long-term productivity.**

- **The four states with the most wind erosion on cropland (Texas, Minnesota, Montana and Colorado) had 58% of all cropland wind erosion in the Nation. By contrast, the three states with the highest average annual rates of cropland wind erosion (New Mexico, Arizona, and Nevada) had only 5% of all cropland wind erosion because cropland is not extensive in those states.**

- **Erosion control is not a permanent accomplishment. Changes in conservation technology and application need to keep pace with changes in natural resources conditions, land use and production technology and methods.**



Did You Know?
Annual wind erosion on cropland dropped from 1.4 billion tons in 1982 to 0.9 billion tons in 1992.

Source of information is the National Resources Inventory, distributed by USDA/NRCS

News Release
Rep. Robert F. (Bob) Smith (R-OR), Chairman
House Committee on Agriculture

FOR IMMEDIATE RELEASE
April 23, 1997

Contact: Dave Redmond
(202) 225-4030

SCIENTIST CALLS EPA AIR QUALITY RULES "GROSSLY IN ERROR" AS CHAIRMAN COMBEST CALLS FOR MORE ACCURATE SCIENCE

WASHINGTON, D.C. – TESTIFYING BEFORE A KEY HOUSE SUBCOMMITTEE, A TEXAS AGRICULTURAL ENGINEER AND AIR QUALITY EXPERT TODAY SAID THE ENVIRONMENTAL PROTECTION AGENCY'S (EPA) NEW NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS) FOR PARTICULATE MATTER IS "GROSSLY IN ERROR," BASED ON FAULTY DATA, AND SHOULD BE WITHDRAWN.

On November 27, 1996, EPA proposed new ambient air quality standards for ozone and particulate matter, which EPA says are necessary to meet the Clean Air Act's requirement that air pollution not adversely affect public health. If adopted as proposed, the new standards would substantially increase the number of areas not attaining the Act's air quality standards and magnify the difficulties faced by non-attainment areas.

The witness, Dr. Calvin Parnell, a Professor of Agricultural Engineering at Texas A&M University and member of the U.S. Department of Agriculture's Task Force on Air Quality, testified today before the House Agriculture Subcommittee on Forestry, Resource Conservation, and Research, Chaired by Rep. Larry Combest (R-TX).

Parnell testified that data on sources of particulate emissions suggesting that 34% of fine particulate matter can be attributed to agriculture and forestry is "grossly in error."

"The data used to develop this inventory was based on erroneous emission factors published by EPA for cattle feed yards, feed mills, grain elevators and dust from farmers' field operations. Had EPA and their contractors had agricultural engineers participating in the studies that resulted in the erroneous emission factors...we would not be faced with the difficult task of convincing EPA that the numbers need to be changed today," Parnell testified.

"The science employed in developing this rule is not up to par, and I'm concerned that farmers could bear the brunt of a bad policy based on equally bad science," Combest said. "These scientists who know agriculture told us today that EPA really has the cart before the horse. We don't have the research yet to know whether we can actually attain these standards, how much it will cost the agriculture industry and the consuming public, and how much agricultural activity actually contributes to air pollution problems."

"It is imperative that any decisions that are made on air quality standards be substantiated by sound science. According to much of the testimony we heard today, it appears that EPA's proposed standards do not reflect the science that is available. This committee must continue its oversight authority to ensure that a fair and justifiable standard is ultimately set," said Rep. Cal Dooley (D-CA), the Subcommittee's Ranking Democrat.

Combest represents Texas' 19th Congressional District, which includes the Panhandle, South Plains, and the Permian Basin. Dooley represents California's 20th Congressional District.

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COMMERCE COMMITTEE

NEWS RELEASE

FOR IMMEDIATE RELEASE
WEDNESDAY, APRIL 9, 1997

CONTACT: MIKE COLLINS
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USDA, SBA QUESTION NEW EPA CLEAN AIR RULES, DOCUMENTS SHOW
Scientific Justification Questioned, Impact on Small Businesses and Farmers Cited

WASHINGTON (April 8) – In documents released today by the House Commerce Committee, both the Department of Agriculture and the Small Business Administration questioned the EPA's proposed new air quality standards for fine dust and ground-level ozone, charging that the new standards "are not based on adequate scientific evidence" and would have a "large economic impact" on "tens of thousands, if not hundreds of thousands of small businesses" and farms.

The documents, handed over to the Commerce Committee in response to a request by Chairman Tom Bliley (R-VA), show that both the Agriculture Department and the Small Business Administration challenged the new rules. The Agriculture Department was especially critical, charging that "it is premature for the EPA to change the existing standard until scientific evidence is correctly obtained and interpreted" and noting the concerns of farm groups that the new standards "may impose significant costs" on farmers, particularly the 71 percent of U.S. farms with annual sales of less than $40,000. The documents also suggest that the proposed regulations may drive up farming costs such as fuel, fertilizers, pesticides, and chemicals.

In correspondence with the Office of Management and Budget, the Agriculture Department noted its agreement with the Small Business Administration regarding the potential impacts of EPA's proposals on small businesses. In a November, 1996 letter to EPA Administrator Carol Browner, the SBA had charged that EPA's proposed rules would have "shockingly high impacts" on small businesses, and emphasized that the proposals are "certainly one of the most expensive regulations, if not the most expensive regulation faced by small businesses in ten or more years."

In releasing the documents today, Bliley charged that "they show, once again, that serious concerns about the justification and impact of the EPA's new rules exist within the Clinton Administration itself."

Bliley pledged that the Commerce Committee "will continue to vigorously explore the scientific basis of EPA's proposals, and redouble our efforts to force EPA to obtain and make available the data underlying the key studies upon which the agency relied in writing these rules – something that, to date, EPA has not done."

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EDITORS : TO OBTAIN COPIES OF THE USDA AND SBA DOCUMENTS (12 PAGES), CALL 202-225-

Long-range transport of North African dust to the eastern United States

by

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Long-range transport of North African dust to the eastern United States

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Abstract. The long-range transport of North African dust to the Middle East, Europe, South America, and the Caribbean has been well documented during the past 25 years. With the advent of routine collection and analysis of fine aerosols at national parks, monuments, and wilderness areas in the continental United States, these North African dust incursions can now be tracked, characterized, and quantified across much of the eastern half of the U.S. Identification of the North African source of these dust episodes is confirmed by mass distribution measurements, a characteristic Al/Ca ratio, isentropic backward air-mass trajectories, and sequential plots of the spatial distribution of the dust plumes. North African dust incursions into the continental U.S. persist for ~10 days and occurred, on average, 3 times per year from 1992 to 1995. Fine soil mass usually exceeds 10 $\mu g\ m^{-3}$ during these dust episodes and dominates local fine soil dust by an order of magnitude or more, even in the so-called "dust bowl" states of the central U.S. Size-resolved measurements of elemental composition taken during July 1995 indicate that the mass mean diameter of the transported North African dust is < 1 μm. The high mass scattering efficiency and abundant particle surface area associated with these submicron soil aerosols could have important consequences for both the radiative balance of the region and the chemistry of the local aerosols during summer when the long-range transport of North African dust to the U.S. is most common.

1. Introduction

The arid regions of North Africa are a prodigious source of soil dust. Every year, vast quantities of soil are lofted from the earth's surface during dust storms and transported away from the continent on the prevailing winds [*Chester et al.*, 1971; *Carlson and Prospero*, 1972; *Parkin et al.*, 1972; *Prospero and Carlson*, 1972]. These dust plumes are plainly visible in satellite photographs, extend for thousands of kilometers, and can persist for many days. They have extremely deleterious effects on the air quality near the African continent, but are also important on a global scale. For example, the North African dust reduces visibility, modifies the temperature structure of the atmosphere [*Carlson and Caverly*, 1977; *Karyampudi and Carlson*,

1988], provides important nutrients to and influences the biogeochemistry of oceanic ecosystems [*Savoie and Prospero*, 1980; *Graham and Duce*, 1982; *Carder et al.*, 1986; *Talbot et al.*, 1986; *Duce et al.*, 1991; *Kremling and Streu*, 1993; *Gelado-Caballero et al.*, 1995; *Swap et al.*, 1996] and terrestrial ecosystems [*Graham and Duce*, 1982; *Reichholf*, 1986; *McDowell et al.*, 1990], acts to neutralize the acidity of precipitation [*Prodi and Fea*, 1979; *Loÿe-Pilot et al.*, 1986; *McDowell et al.*, 1990; *Talbot et al.*, 1990; *Sequeira*, 1991; *Rodà et al.*, 1993], and alters the albedo over large regions of the northern hemisphere [*Fraser*, 1976; *Carlson*, 1979; *Coakley and Cess*, 1985; *Jankowiak and Tanre*, 1992; *Li et al.*, 1996; *Swap et al.*, 1996; *Sokolik and Toon*, 1996; *Tegen et al.*, 1996]. The frequency and severity of the North African dust events is also thought to be a sensitive indicator of desertification of the Sahel region of Africa [*Prospero and Nees*, 1977, 1986; *Tegen and Fung*, 1995; *Swap et al.*, 1996].

Although gravitational settling quickly removes the largest soil particles from the dust plumes [*Westphal et al.*, 1987], North African dust is regularly transported to places as far away as Europe [*Pitty*, 1968; *Chester et al.*, 1984; *Prodi and Fea*, 1979; *Reiff et al.*, 1986; *Alpert and Ganor*, 1993], the Middle East [*Ganor*, 1991], South America [*Prospero et al.*, 1981; *Talbot et al.*, 1990; *Swap et al.*, 1992], and the Caribbean [*Carlson and Prospero*, 1972; *Glaccum and Prospero*, 1980; *Morales*, 1986], where dust concentrations have reached 500 $\mu g\ m^{-3}$ [*Talbot et al.*, 1986]. In fact, North African dust is so common in the Caribbean that it is believed to be the parent material of certain soils on mountainous islands in the region [*Muhs et al.*, 1990].

Although North African dust has also been observed on the southeastern coast of the U.S. (e.g., Miami, Florida) [*Prospero and Carlson*, 1972; *Savoie and Prospero*, 1977; *Carder et al.*,

1986], and in the Midwestern U.S. (Illinois) [*Gatz and Prospero*, 1996], the frequency, spatial extent, and mass concentrations of these dust incursions have not previously been characterized. This paper uses data from the Interagency Monitoring of Protected Visual Environments (IMPROVE) fine aerosol monitoring network [*Eldred et al.*, 1990; *Malm et al.*, 1994] to show that significant concentrations of North African dust are regularly transported to the eastern U.S. during the summer months. A brief overview of the instrumentation and IMPROVE network is followed by a detailed case study of a particularly large dust episode to establish its provenance. The frequency, typical spatial extent, mass concentration, and mass distribution of the North African dust episodes in the eastern U.S. are then estimated. Some potential consequences of the large dust episodes are mentioned in the last section of this paper.

2. Instrumentation and Data Set Description

Most of the data presented in this paper was collected as part of the normal operation of the IMPROVE fine aerosol monitoring network. This network has ~70 sites in the contiguous U.S., Alaska, Hawaii, and U.S. Virgin Islands (Fig. 1). A detailed description of the standard IMPROVE aerosol sampling system, protocols, and analysis techniques can be found in *Eldred et al.* [1990] and *Malm et al.* [1994]. Thus, only a brief description of the sampling and analysis techniques relevant to this paper are provided.

The IMPROVE network samplers operate two times per week (Wed. and Sat.) for a 24-hour period starting at midnight. It collects particles with diameters < 2.5 μm (i.e., $PM_{2.5}$) and < 10 μm (i.e., PM_{10}) on chemically inert, 25 mm stretched Teflon filters. The $PM_{2.5}$ Teflon filters are analyzed gravimetrically, by Particle Induced X-ray Emission (PIXE), and by X-ray

Fluorescence (XRF) to provide measurements of particle mass and elemental composition [*Cahill et al.*, 1984; *Malm et al.*, 1994]. The PM_{10} aerosols collected on the Teflon filters, however, are typically analyzed for gravimetric mass only. The IMPROVE network also collects $PM_{2.5}$ aerosols on Nylon filters that are analyzed by ion chromatography to provide measurements of particulate nitrate and sulfate ions. To prevent the unwanted collection of gaseous nitric acid (HNO_3) and sulfur dioxide (SO_2) on the Nylon filters, potassium carbonate (K_2CO_3) coated denuders are placed within the sampling inlets of these modules.

Estimates of the soil dust concentration are made by combining the masses of the elements predominantly associated with the Earth's crust (i.e., Al, Ca, Fe, Si, and Ti) [*Flocchini et al.*, 1981; *Cahill et al.*, 1981]. These crustal elements are assumed to be in the form of their normal oxides [*Seinfeld*, 1986] and must, therefore, be multiplied by their corresponding molar correction factors [*Malm et al.*, 1994] before they are combined to calculate the mass of the soil. A 16% correction is then made to account for the presence of other soil elements, such as K, Na, Mn, Mg, and V, that are not included in the linear combination. Justification for this procedure and the formula that is used to estimate the soil dust concentrations can be found in *Malm et al.* [1994].

An 8-stage Davis Rotating-drum Unit for Monitoring (DRUM) impactor [*Cahill et al.*, 1985] was used to make size-resolved measurements of elemental composition during the Southeastern Aerosol Visibility Study (SEAVS) that took place at Great Smoky Mountains National Park (Tennessee) from 15 July - 31 August, 1995 (Fig. 1). The DRUM is a Lundgren-type, rotating drum, cascade impactor that uses a series of single round jets to separate aerosols based on their

aerodynamic diameters. It operates at a flow of 1.1 liters min^{-1} and separates aerosols into the following size ranges: ~15 - 10 μm, 10 - 5.0 μm, 5.0 - 2.5 μm, 2.5 - 1.15 μm, 1.15 - 0.56 μm, 0.56 - 0.34 μm, 0.34 - 0.24 μm, and 0.24 - 0.069 μm [*Raabe et al.*, 1988]. Aerosols were collected on 480 μg cm^{-2} mylar strips that had been coated with a 5 μg cm^{-2} layer of Apiezon type L grease to minimize particle bounce-off. This grease coating reduces the mass of incorrectly sized soil particles in the smaller stages of the DRUM impactor by a factor of 1000 [*Cahill et al.*, 1985]. A 25 mm stretched Teflon after-filter collects aerosols with aerodynamic diameters < 0.069 μm. The DRUM stages were set to rotate 2 mm every four hours and were analyzed by PIXE to provide size-resolved measurements of elemental composition with four hour resolution.

3. Case Study of a Regional Dust Episode in the Eastern U. S.

Several extremely large soil dust episodes have been observed in the eastern half of the U.S. during the last five years. In this section, one of these events is described in detail to provide evidence that the dust originated from North Africa. The long-range transport of North African dust into the interior of the continental U.S. is plausible given that copious quantities of North African dust are regularly transported to the Caribbean (Fig. 2) [*Carlson and Prospero*, 1972; *Glaccum and Prospero*, 1980; *Morales*, 1986; *Swap et al.*, 1996]. The soil concentrations associated with the these dust episodes are so large that the annual mean $PM_{2.5}$ soil concentration is much higher at Virgin Islands National Park (3.25 μg m^{-3}) which is in the Caribbean Sea than at any of the sites shown in Fig. 1 (Table 1). This remarkable fact makes Virgin Islands National Park the dustiest of all the IMPROVE sites.

The dust episode that this section describes took place from 23 June - 7 July, 1993. The first indication of the dust episode occurred when $PM_{2.5}$ soil concentrations began to increase sharply at Virgin Islands National Park on 19 June (Fig. 2c). Within 4 days of the arrival of this dust-laden air mass to the Caribbean, the $PM_{2.5}$ soil concentration at Everglades National Park in southern Florida also began to increase (Fig. 3a). By 30 June, the soil dust had progressed northwest to Upper Buffalo Wilderness Area (Arkansas) where $PM_{2.5}$ soil concentrations exceeded 11 $\mu g\ m^{-3}$ (Fig. 3c). In addition, $PM_{2.5}$ soil concentrations were > 2 $\mu g\ m^{-3}$ at sites as far west as Big Bend National Park (Texas) and Rocky Mountain National Park (Colorado) on this date (Fig. 3c). The maximum $PM_{2.5}$ soil concentrations in the continental U.S. during this episode (19.9 $\mu g\ m^{-3}$) occurred on 3 July at Sipsey Wilderness Area (Alabama) and Upper Buffalo Wilderness Area (Fig. 3d) and were equivalent to the $PM_{2.5}$ soil concentration measured at Virgin Islands National Park on 30 June. The dust plume's maximum spatial extent occurred on 7 July (Fig. 3e) when nearly all of the eastern U.S., including the state of Maine (Acadia National Park), had soil concentrations > 3 $\mu g\ m^{-3}$.

The $PM_{2.5}$ soil concentrations associated with this dust episode were extremely high. For example, the maximum $PM_{2.5}$ soil concentration was ~40 times greater than the median of all the IMPROVE sites during the summer of 1993 (Fig. 4). More surprising, however, is the fact that the dust plume in the eastern U.S. had soil concentrations that were more than twice the maximum value observed anywhere in the western U. S. during the entire summer of 1993 (The maximum value in the western U.S. was 8.72 $\mu g\ m^{-3}$ and occurred in Texas at Big Bend National Park on 8 August, 1993). In addition, 98% of all the IMPROVE network's $PM_{2.5}$ soil mass

measurements > 3 μg m^{-3} made during the summer of 1993 occurred in the eastern half of the U.S. (Fig. 4). These data contradict the widely held notion that the arid regions of the western U.S. have the highest $PM_{2.5}$ soil dust concentrations in the U.S. It also suggests that the large dust episode of 23 June - 7 July did not originate in the western U.S.

Neither the climatology of dust events nor the meteorology of June 1993 favor a U.S. source for this regional dust episode. *Gillette and Hanson* [1989] examined wind and dust data from 1948-1978 and determined that the maximum dust production within the U.S. occurs in spring while the minimum occurs during summer. A review of the National Weather Service (NWS) records indicates that the spring of 1993 was characterized by above-normal precipitation throughout much of the central and western U.S. In fact, large areas in the central U.S. reported more than 200% of normal rainfall during the month of June [*Ludlum*, 1993]. As a result, it is not surprising that a detailed examination of the hourly weather observations from 9 primary NWS sites in Kansas, Nebraska, New Mexico, Oklahoma, and Texas did not reveal any observations of blowing dust during the months of June and July. Similarly, the U.S. Department of Agriculture (USDA) research service facility at Big Spring, Texas, which maintains an extensive archive on U.S. dust episodes, does not have any reports of blowing dust during June and July, 1993. Additional weather observations, maintained at Texas Tech University, indicate that several localized dust events observed in the Southern High Plains resulted from outflow winds of convective storms and not synoptic-scale dust outbreaks. Thus, it is very unlikely that the regional dust event from 23 June - 7 July originated in the western U. S.

A 10-day backward, isentropic, air-mass trajectory originating at Shenandoah National Park (Virginia) on 7 July, 1993 indicates that the dust-laden air mass in the Caribbean (Fig. 2) was transported through the Gulf of Mexico and then into the southeastern U.S. (Fig. 5). This type of air mass trajectory is very common during the summer months when a semi-permanent high pressure zone, known as the "Bermuda" high, establishes itself off the east coast of Florida. Since North African dust usually takes ~1 week to traverse the Atlantic Ocean [*Carlson and Prospero*, 1972], the soil particles would need to have an atmospheric lifetime of at least two and a half weeks to be transported from North Africa to the U.S. Although most of the particles with diameters > 2.5 μm will not survive this journey, it is possible that a significant fraction of the $PM_{2.5}$ soil particles could remain in the atmosphere for this length of time if they were not removed by precipitation processes.

A comparison of average elemental ratios (Table 2) indicates that the composition of the soil within the dust plume in the eastern half of the U.S. was very similar to that measured at Virgin Islands National Park between 23 June and 7 July, 1993. For example, the average soil elemental ratios at sites in the eastern U.S. dust plume (i.e., sites with $PM_{2.5}$ soil concentrations ≥ 3 μg m^{-3}) were highly correlated ($R^2 = 0.98$) with those at Virgin Islands National Park (Fig. 6a). In addition, the least squares linear regression of the elemental ratios (dotted line in Fig. 6a) had a slope of 0.95. This high correlation indicates that the elemental composition of the soil dust during the regional dust episode was nearly identical at these two locations. By contrast, some of the average elemental ratios at sites in the eastern U.S. with low soil concentrations (i.e., $PM_{2.5}$ soil concentrations < 3 μg m^{-3}) were very different than those measured at Virgin Islands

National Park (Fig. 6b and Table 2). The largest differences were observed in the Si/Ca and Al/Ca ratios. The comparatively low Si/Ca and Al/Ca ratios of the sites in the eastern U.S. that were not influenced by the dust plume resulted in a least squares linear regression slope of only 0.22. The differences in soil composition are used in section 4.1 to differentiate between U.S. soils and those that are transported from a distant source.

Although no detailed aerosol mass distribution measurements were made during this dust episode, measurements of both the coarse (i.e., particles with diameters > 2.5 μm and < 10 μm) and fine (i.e., $PM_{2.5}$) soil mass concentrations are available at Shenandoah National Park from March 1993 to March 1994. Figure 7 shows that the ratio of fine to coarse soil is significantly elevated during this dust episode. The dearth of coarse soil is consistent with long-range transport during which the largest soil particles are preferentially removed by gravitational settling or precipitation processes.

The spatial and temporal patterns (Fig. 3), the air-mass trajectory (Fig. 5), the elemental ratios (Table 2 and Fig. 6), and the relatively small size of the soil particles (Fig. 7) are all consistent with transport from the Caribbean. When these factors are combined with the known transport of North African dust to the Caribbean (Fig. 2) and the lack of evidence of dust events within the U.S., it becomes clear that this dust episode originated from North Africa. The large-scale impact of North African dust on the aerosol burden of the eastern U.S. is strongly supported by Advanced Very High-Resolution Radiometer (AVHRR) satellite measurements. The AVHRR measurements often show a plume of enhanced aerosol optical thickness extending

from the west coast of Africa, across the Atlantic and into the Gulf of Mexico and along the southeastern coast of the U.S. during the summer months [*Husar et al.*, submitted 1996].

4. Characterization of North African Dust Transport to the U.S.

The large dust episode highlighted by the previous case study was not an isolated event. Dust episodes of various size and duration are quite common in the eastern half of the U.S. during the summer months. For example, 5 of the top 6 sites with the highest mean $PM_{2.5}$ soil concentrations during summer are located in the eastern half of the U.S. (Table 1). This spatial distribution contrasts sharply to the spring when 14 of the top 15 sites with the highest mean $PM_{2.5}$ soil concentrations are located in the southwestern U.S. The high soil concentrations in this region, during spring, are consistent with known spatial and seasonal patterns of dust generation within the U.S. [*Gillette and Hanson*, 1989].

Although the summertime dust episodes in the eastern U.S. have a large impact on the mean soil concentrations, their impact on the radiative balance of the region will primarily be determined by the frequency of the dust episodes, their spatial extent, the mass concentration of soil particles in the dust plume, and the mass distribution of those particles. The next four sections summarize the available data to provide estimates of these important quantities.

4.1 Frequency of North African Dust Transport to the U.S.

To determine how frequently individual sites are impacted by North African dust it is necessary to devise a criterion that distinguishes between North African dust episodes and those of U.S. origin. Since the dust episodes at Virgin Islands National Park are known to be of North

African origin, data from this site (1990 - 1995) are used to develop a two-part criterion that will be applied to sites in the continental U.S. to identify the presence of North African dust. Since the North African dust episodes are characterized by extremely high $PM_{2.5}$ soil concentrations, the first part of our criterion is based on soil mass. The second part of the criterion is based on the Al/Ca ratio which is significantly elevated for transported North African dust (Table 2).

The first criteria used to identify the presence of North African dust is a $PM_{2.5}$ soil concentration ≥ 3 $\mu g\ m^{-3}$. A histogram of $PM_{2.5}$ soil concentrations at Virgin Islands National Park shows a bimodal distribution with one peak at ~ 0.075 $\mu g\ m^{-3}$ and the other at ~ 5 $\mu g\ m^{-3}$ (Fig. 8b). This type of distribution occurs because soil concentrations are generally very low at this site except when North African dust is transported to the Caribbean (Fig. 8a). A threshold value of 3 $\mu g\ m^{-3}$ was chosen because it is the 25th percentile of the portion of the distribution dominated by North African dust. Thus, this criteria alone could exclude up to ~25% of the North African dust events that occur at this site.

The second criteria used to identify the presence of North African dust is an Al/Ca ratio > 3.8. The Al/Ca ratio was chosen because it exhibited the largest difference between high and low dust conditions at Virgin Islands National Park from 1990 to 1995. For example, during this period the Al/Ca ratio was ~2.3 times higher, on average, when soil concentrations exceeded 3 $\mu g\ m^{-3}$ (Table 2). In addition, the monthly averaged soil concentrations and Al/Ca ratios are highly correlated (R^2=0.96) and peak during the summer months when vast quantities of North African dust are transported to the Caribbean (Fig. 8a) [*Prospero and Nees*, 1977, 1986; *Prospero et al.*, 1987]. Both of these factors indicate that a high Al/Ca ratio is an effective tracer

of North African dust. A threshold value of 3.8 was chosen because it is the 25th percentile of all the Al/Ca ratios at Virgin Islands National Park when $PM_{2.5}$ soil concentrations exceed 3 $\mu g\ m^{-3}$. Since nearly all of the soil measurements > 3 $\mu g\ m^{-3}$ at Virgin Islands National Park are due to transported North African dust, the Al/Ca ratio criterion could exclude up to 25% of the North African dust events at this site.

The two-part, North African dust criterion is designed to provide a conservative estimate of how often North African dust impacts individual sites. Figure 8c provides a graphical display of the two-part criterion using data from Virgin Islands National Park. Only those data points above and to the right of the two lines are considered to be of North African origin. This criterion was applied to the 28 IMPROVE sites shown in Fig. 3 to determine what percent of the observations each month were affected by North African dust. The results of this analysis are shown in Table 3. This table clearly demonstrates that the two-part criterion is very effective at distinguishing between dust episodes of U.S. and North African origin. For example, although dust episodes originating in the U.S. are common during the spring, none of the sites listed in Table 3 had a $PM_{2.5}$ soil concentration ≥ 3 $\mu g\ m^{-3}$ and an Al/Ca ratio > 3.8 during the spring.

North African dust transport to the U.S. is primarily a summertime phenomenon with a maximum frequency during the month of July (Table 3). The frequency of North African dust events is greatest in the southeastern U.S. and generally decreases to the north. Table 3 also shows that significant concentrations of North African dust are present in the eastern half of the U.S. at least 15-20% of the time during the month of July. More surprising, however, is the evidence showing that North African dust is regularly transported as far west as Texas (Table 3).

For example, Fig. 9 shows two distinct peaks in the monthly averaged soil concentration at Big Bend and Guadalupe Mountains National Parks (Texas): one in April/May and the other in July. However, the Al/Ca ratio has only one peak that occurs during July. The fact that the summertime dust episodes at these national parks are calcium deficient is particularly important because the Guadalupe Mountains massif is composed of limestone and the minerals precipitated on the surface playa near the park are primarily calcium salts [*Boyd and Kreitler*, 1986]. Thus, the high Al/Ca ratio associated with these dust episodes could not have been generated locally. In addition, the summertime dust episodes at Big Bend and Guadalupe Mountains National Parks usually coincide with North African dust events in the eastern half of the U.S. (e.g., Fig. 3d).

It should be noted that most of the sites in the northeastern U.S. were excluded from Table 3 because they did not have 3 complete years of data for the summer months. The exclusion of these data should not be interpreted to mean that this region is devoid of North African dust. For example, Fig. 3 illustrates North African dust being transported all the way to the state of Maine. Similarly, the lack of IMPROVE sites in the central U.S. does not indicate that North African dust is infrequent in this region. In fact, the high frequency of North African dust at Upper Buffalo Wilderness Area (Arkansas) indicates that the central U.S. could be significantly affected by North African dust during much of the summer. This contention is strengthened by *Gatz and Prospero* [1996] who presented data showing a large silicon-aluminum aerosol plume in the Midwestern U.S. (Illinois) during July of 1979. Although they could not conclusively demonstrate that the soil dust originated from North Africa, the soil concentration was > 3 $\mu g\ m^{-3}$

and the Al/Ca ratio was ~ 4. Thus, the soil dust incursion documented by *Gatz and Prospero* [1996] meets the two-part North African dust criterion developed in this section.

4.2. Typical Spatial Extent of North African Dust Episodes in the U.S.

The potential impact of the North African dust on the radiative balance in the eastern U.S. will depend, to a large degree, on the spatial extent of the dust episodes. Table 4 lists the dates, estimated maximum spatial extent, and maximum $PM_{2.5}$ soil concentrations of all the dust episodes that occurred in the U.S. (1992 to 1995) that met the two-part North African dust criterion. Unfortunately, the spatial coverage of the fine aerosol monitoring network was not sufficient to permit this type of analysis prior to 1992. The maximum spatial extent of the dust episodes was estimated by determining how much land area in the continental U.S. had a $PM_{2.5}$ soil concentration $\geq 3\ \mu g\ m^{-3}$ and an Al/Ca ratio > 3.8.

Almost half of the dust episodes (10 out of 22) were observed only within the state of Florida. These episodes were short-lived (i.e., < 3 days) and had maximum $PM_{2.5}$ soil concentrations $< 10\ \mu g\ m^{-3}$. By contrast, the larger regional dust episodes generally persisted for more than a week and had an average maximum soil concentration of $19.7\ \mu g\ m^{-3}$ ($\sigma = 8.36$). These dust episodes persisted for ~10 days and covered ~15% of the continental U.S. (i.e., $1.3 \times 10^6\ km^2$), on average. However, the largest dust event in 1992 extended over ~30% of the U.S.

It is important to note that the seasonal modulation, frequency, and spatial extent of North African dust episodes in the U.S. are all critically dependent upon meteorology. For example, the seasonal pattern of dust transport to the Caribbean is controlled, to a large extent, by the location of the inter-tropical convergence zone (ITCZ). As the ITCZ migrates northward during

the northern hemispheric summer, it forces the airflow patterns in the tropical North Atlantic Ocean to become more easterly (Fig. 10), increasing the frequency of North African dust transport to the Caribbean from May to September (Fig. 2) [*Prospero et al.*, 1981]. During the northern hemispheric winter, the ITCZ migrates southward and the airflow in the tropical North Atlantic becomes northeasterly resulting in the transport of North African dust to South America [*Prospero et al.*, 1981]. This alternate transport pathway explains why North African dust transport to the Caribbean is relatively infrequent from October to April.

The transport of North African dust from the Caribbean to the interior of the continental U.S. could depend, to a large extent, on the strength and location of the semi-permanent "Bermuda" high pressure zone (Fig. 10). If the "Bermuda" high is located far off the eastern coast of Florida, the clockwise circulation around the high pressure zone could transport the North African dust to the east of the U.S. coast. In this scenario, North African dust would not be transported to the interior of the continental U.S., but might be observed at coastal sites along the Atlantic seaboard or at offshore islands such as Bermuda and the Bahamas. The large percent of the continental U.S. North African dust episodes that are observed only in Florida (Table 4) could indicate that this scenario is quite common. This contention is supported by the significantly elevated aluminum concentrations that are frequently measured at the Atmosphere/Ocean Chemistry Experiment (AEROCE) site located on the island of Bermuda [*Arimoto et al.*, 1992, 1995]. If the "Bermuda" high is shifted to the west, the circulation around the high pressure zone could transport the North African dust into the southeastern U.S. (e.g., Fig. 3). The transport of North

African dust into the central U.S. and Texas would be facilitated by a westward-shifted "Bermuda" high (Fig. 10).

4.3. Typical $PM_{2.5}$ Soil Mass Concentrations

Although the maximum $PM_{2.5}$ soil concentrations are correlated with the maximum spatial extent of the dust events (R^2 = 0.77), the highest soil concentrations are not necessarily representative of the dust episode as a whole. To overcome this potential problem the mean $PM_{2.5}$ soil concentration was calculated during each of the regional dust events by averaging the soil concentrations measured at all of the sites that met the two-part, North African dust criterion (Table 4). The results of these calculations are also included in Table 4. The mean $PM_{2.5}$ soil concentration for the regional dust episodes was 8.75 $\mu g\ m^{-3}$ (σ = 2.34).

4.4. Soil Mass Distribution of the 22-26 July, 1995 North African Dust Episode

In this section, size-resolved measurements from the DRUM impactor are used to provide a detailed description of the soil mass distribution at Great Smoky Mountains National Park during the 22-26 July, 1995 North African dust episode. The 12-hr averaged $PM_{2.5}$ soil concentration was initially < 1 $\mu g\ m^{-3}$ but rose to over 8 $\mu g\ m^{-3}$ on 25 & 26 July, 1995 (Fig. 11a). Figure 11b shows that the soil concentration and composition on these two days met the two-part North African dust criterion developed in section 4.1. In addition, Table 4 shows that the high $PM_{2.5}$ soil concentrations measured at this site occurred during a regional North African dust event. Although this dust episode is clearly of North African origin, it was relatively small with an

estimated maximum spatial extent of only 0.4 x 10^6 km^2 and a maximum $PM_{2.5}$ soil concentration of 9 $\mu g\ m^{-3}$.

The average soil mass distribution for this dust event is bimodal with one peak at ~0.9 μm and another > 2.5 μm (Fig. 12). The lack of data for particles > 10 μm precludes the precise determination of the peak of the larger size mode. The presence of a significant submicron mode in the soil mass distribution is characteristic of soil dust that has been transported thousands of kilometers [*Duce et al.*, 1976, 1983; *Shaw*, 1980; *Prospero*, 1981; *Schütz et al.*, 1981; *Braaten and Cahill*, 1986; *Talbot et al.*, 1986; *Arimoto et al.*, 1987; *Prospero et al.*, 1989]. The transition from a supermicron dominated to a submicron dominated soil mass distribution results in an enhancement of the mass scattering efficiency of the soil particles as they undergo long-range transport.

5. Conclusions

In this paper data from the IMPROVE fine aerosol monitoring network (1988-1995) is used to demonstrate that significant quantities of North African dust are regularly transported to the eastern half of the U.S. A two-part North African dust criterion is developed to distinguish between U.S. soils and North African dust. The two-part criterion, which consists of a $PM_{2.5}$ soil concentration ≥ 3 $\mu g\ m^{-3}$ and an Al/Ca ratio > 3.8 is used to determine the frequency and seasonality of the North African dust incursions. The dust episodes are most common during the month of July, but are observed throughout the summer. Maximum $PM_{2.5}$ soil concentrations during these events are typically 20 - 30 $\mu g\ m^{-3}$ and are several times larger than comparable measurements at IMPROVE sites in the western U.S. during summer. The North African dust

plumes begin with very high $PM_{2.5}$ soil concentrations in the extreme southeastern U.S. (i.e., Virgin Islands National Park and Florida). The North African dust plumes are usually transported in a clockwise direction around the semi-permanent "Bermuda" high pressure zone located off the eastern coast of Florida. This transport path carries the soil dust through the Gulf of Mexico and then into the central or southeastern U.S. Under certain conditions (i.e., no precipitation) these dust plumes can be tracked until they exit from the east coast of the U.S. and return to the Atlantic Ocean. North African dust has been also been identified at locations as far west as Big Bend National Park and Guadalupe Mountains National Park in Texas and as far north as Acadia National Park in Maine. From 1992 to 1995 the dust episodes occurred 3 times per year, on average, and persisted for ~10 days. Although the average maximum spatial extent of the North African dust episodes in the U.S. was 1.3×10^6 km^2, the largest extended over 2.4×10^6 km^2 (~30% of the continental U.S.).

The most important impact of North African dust transport to the U.S. could be its effect on the radiative balance of the region. These North African dust plumes have extremely high submicron soil concentrations, extend over large portions of the continental U.S., are relatively frequent during the season of maximum solar insolation (i.e., summer), and are transported into the central U.S. where anthropogenic aerosol concentrations are relatively low. All of these factors indicate that these dust episodes could have a substantial effect on the radiative forcing by aerosols in the eastern U.S. and its coastal waters during summer.

The presence of extremely high concentrations of North African soil dust could also have a significant impact on the chemistry of the local aerosols and precipitation in the eastern U.S. For

example, the soil dust has a very high surface area per unit mass which makes it an ideal site for heterogeneous chemical reactions [*Cahill et al.*, 1992; *Ferek et al.*, 1992; *Dentener et al.*, 1996]. In addition, the North African dust is transported to the eastern U.S. during summer when the local aerosols and precipitation are most likely to be highly acidic. The presence of significant quantities of alkaline soil particles in this region could help moderate the acidity of the local aerosols and precipitation. Although the North African dust could have significant impacts on the chemistry and aerosol radiative forcing in the eastern U.S. during summer, further studies of the physical, chemical, and optical properties of the transported dust are necessary to quantify these effects.

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Disclaimer. Names of commercial products are necessary to report factually on available data and instruments used. However, neither the USDA nor the authors' institutions guarantees nor warrants the standard of the products; and the use of the name implies no approval of the product to the exclusion of others that may be available.

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Table 1. Mean $PM_{2.5}$ soil concentration ($\mu g\ m^{-3}$) as a function of season for the 15 dustiest IMPROVE sites (1988-1995)*

	Total		Spring (Mar., Apr., May)		Summer (Jun., Jul., Aug.)		Fall (Sept., Oct., Nov.)		Winter (Dec., Jan., Feb.)	
Site	Rank	Mean	Rank	Mean *Median* Max	Rank	Mean *Median* Max	Rank	Mean *Median* Max	Rank	Mean *Median* Max
Virgin Islands‡ (Caribbean)	1	3.25	1	2.27 *0.31* 40.8	1	7.58 *6.12* 30.9	1	2.49 *0.39* 31.0	1	0.67 *0.11* 10.2
Guadalupe Mountains‡ (Texas)	2	1.22	2	1.80 *1.37* 15.3	8	1.62 *1.04* 18.5	4	0.90 *0.57* 11.5	2	0.55 *0.39* 4.31
Big Bend‡ (Texas)	3	1.16	6	1.35 *0.92* 22.8	5	2.28 *1.40* 21.8	12	0.58 *0.43* 3.70	4	0.43 *0.30* 2.21
Saguaro° (Arizona)	4	1.08	3	1.68 *1.43* 6.92	13	1.09 *0.88* 6.63	3	0.98 *0.81* 5.19	3	0.55 *0.33* 3.46
Upper Buffalo§ (Arkansas)	5	1.07	>15	0.55 *0.50* 1.96	2	3.02 *0.92* 25.5	>15	0.47 *0.32* 2.02	>15	0.22 *0.18* 0.79
Everglades‡ (Florida)	6	1.05	>15	0.53 *0.34* 7.16	3	2.96 *1.36* 21.4	15	0.55 *0.17* 7.59	>15	0.17 *0.12* 0.84
San Gorgonio§ (California)	7	0.99	10	1.09 *0.79* 6.98	12	1.27 *1.01* 4.27	2	1.32 *0.85* 7.21	13	0.28 *0.17* 5.96
Okefenokee† (Georgia)	8	0.98	>15	0.54 *0.47* 1.26	4	2.84 *1.10* 25.4	>15	0.34 *0.27* 1.63	>15	0.20 *0.20* 0.53
Tonto° (Arizona)	9	0.93	5	1.36 *1.15* 8.53	11	1.28 *1.11* 4.37	8	0.72 *0.60* 3.04	6	0.35 *0.23* 3.28
Jarbidge§ (Nevada)	10	0.92	15	0.92 *0.64* 5.23	7	1.73 *1.66* 5.62	5	0.85 *0.51* 3.64	>15	0.17 *0.09* 5.72
Great Sand Dunes° (Colorado)	11	0.91	4	1.60 *0.97* 19.0	14	1.04 *0.81* 5.47	10	0.65 *0.48* 3.02	9	0.34 *0.21* 4.33
Sipsey§ (Alabama)	12	0.90	>15	0.62 *0.53* 1.91	6	2.19 *0.72* 32.3	>15	0.45 *0.42* 1.22	7	0.35 *0.30* 1.42
Yellowstone‡ (Wyoming)	13	0.79	>15	0.92 *0.71* 5.92	10	1.33 *1.04* 5.34	7	0.73 *0.50* 4.91	>15	0.18 *0.13* 1.62
Petrified Forest‡ (Arizona)	14	0.78	8	1.26 *0.99* 6.59	>15	0.95 *0.76* 5.13	13	0.56 *0.51* 1.96	8	0.35 *0.27* 1.72
Chiricahua° (Arizona)	15	0.76	7	1.31 *1.11* 6.65	>15	0.95 *0.74* 6.01	>15	0.49 *0.42* 2.83	14	0.27 *0.20* 1.03

* Only sites that had at least three complete years of data (i.e., > 312 observations) during the period of 1988 - 1995 were included in this table.

† National Wildlife Refuge

‡ National Park

§ Wilderness Area

° National Monument

Table 2. Comparison of $PM_{2.5}$ elemental ratios* in the eastern U.S.† and Virgin Islands National Park.

Dates	Sites/Conditions		Si/Al	Si/Ca	Si/Fe	Al/Ca	Al/Fe	Fe/Ca
23 June - 7 July 1993	Eastern U.S.† High‡ Soil Concentrations	**Mean**	**1.84**	**12.2**	**3.84**	**6.69**	**2.11**	**3.19**
		Stdev.	*0.15*	*1.70*	*0.46*	*1.27*	*0.37*	*0.40*
		#	27	27	27	27	27	27
23 June - 7 July 1993	Eastern U.S.† Low§ Soil Concentrations	**Mean**	**1.88**	**4.27**	**3.25**	**2.35**	**1.74**	**1.44**
		Stdev.	*0.41*	*2.04*	*1.29*	*1.17*	*0.57*	*0.68*
		#	105	105	105	105	105	105
23 June - 7 July 1993	Virgin Islands N. P.	**Mean**	**1.62**	**12.5**	**4.53**	**7.71**	**2.80**	**2.76**
		#	4	4	4	4	4	4
Nov. 1990 through Aug. 1995°	Virgin Islands N. P. High‡ Soil Concentrations	**Mean**	**1.74**	**8.47**	**3.97**	**4.97**	**2.33**	**2.15**
		Stdev.	0.19	2.05	0.49	1.42	0.49	0.60
		#	127	127	127	127	127	127
Nov. 1990 through Aug. 1995°	Virgin Islands N. P. Low§ Soil Concentrations	**Mean**	**2.16**	**4.42**	**3.45**	**2.14**	**1.64**	**1.27**
		Stdev.	*0.42*	*1.88*	*0.46*	*1.02*	*0.34*	*0.47*
		#	118	118	118	118	118	118

* Note: Elemental ratios using Ti were not included in this table because ~30% of the data points for low soil concentration conditions were < 3 times the minimum detectable limit.

† Eastern U.S. sites are defined as all sites shown in Fig. 3 excluding Virgin Islands National Park

‡ $PM_{2.5}$ soil concentration ≥ 3 $\mu g\ m^{-3}$

§ $PM_{2.5}$ soil concentration < 3 $\mu g\ m^{-3}$

° The $PM_{2.5}$ aerosol composition data set from Virgin Islands National Park began in November 1990 and ended in August 1995.

Table 3. Percent of all the observations each month that meet the North African dust criterion (i.e., have a $PM_{2.5}$ soil concentration ≥ 3 μg m^{-3} and an Al/Ca ratio > 3.8). The sites are arranged from north to south. Blank boxes indicate that 0% of the observations met the North African dust criterion. Sites were only included in this table if they had at least three complete years of data for the summer months during the period of 1988 - 1995.

Site	Total Number of Observations	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug	Sept.	Oct.	Nov.	Dec.
Brigantine* (New Jersey)	430						6	6					
Washington D. C.	679							7					
Dolly Sods‡ (West Virginia)	422							14					
Shenandoah† (Virginia)	761							8					
Mammoth Caves† (Kentucky)	404						4	23					
Upper Buffalo‡ (Arkansas)	396						7	37	6				
Great Smoky Mtns.† (Tennessee)	754						2	16	3				
Sipsey‡ (Alabama)	310						8	16					
Guadalupe Mtns.† (Texas)	753							9	3				
Okefenokee* (Georgia)	408						9	27	9				
Big Bend† (Texas)	783						1	19	8				
Chassahowitzka* (Florida)	272						27	19	8	4			
Everglades† (Florida)	581					5	19	57	14	4			
Virgin Islands† (Caribbean)	427		9	6	8	19	64	76	35	27	17		

* National Wildlife Refuge
† National Park
‡ Wilderness Area

Table 4. List of the North African dust episodes that occurred in the U.S. from 1992 to 1995. This list was compiled from all the sites shown in Fig. 1 and is based upon the two-part North African dust criterion developed in section 4.1.

Date (Month/Day)	Year	Date of Max. Spatial Extent (Month/Day)	Estimated Max. Spatial Extent (km^2)	$PM_{2.5}$ Soil Concentration Maximum ($\mu g\ m^{-3}$)	Mean ($\mu g\ m^{-3}$)
6/24 -7/15	1992	7/8	2.4×10^6	32.3	12.2
7/15 - 7/18	1992	7/18	Florida Only	8.3	NA
7/29	1992	7/29	Florida Only	6.7	NA
8/8	1992	8/8	Florida Only	5.2	NA
6/12	1993	6/12	Florida Only	3.6	NA
6/23 - 7/7	1993	7/7	2.0×10^6	19.9	7.9
7/10 - 7/17	1993	7/10	1.6×10^6	25.5	7.4
7/21 - 7/31	1993	7/28	1.4×10^6	14.1	7.5
8/4 - 8/11	1993	8/4	1.3×10^6	21.1	12.1
8/14 - 8/25	1993	8/21	1.2×10^6	9.3	6.0
6/8 - 6/18	1994	6/15	0.5×10^6	8.6	4.6
6/25 - 6/29	1994	6/29	1.5×10^6	29.6	11.9
7/2 - 7/6	1994	7/6	1.1×10^6	12.6	8.8
7/9 - 7/20	1994	7/16	1.2×10^6	25.4	9.9
7/30	1994	7/30	Florida Only	4.5	NA
8/17	1994	8/17	Florida Only	7.1	NA
9/7	1994	9/7	Florida Only	3.6	NA
9/17	1994	9/17	Florida Only	7.6	NA
6/24 - 7/5	1995	7/5	1.3×10^6	29.0	9.4
7/8	1995	7/8	Florida Only	5.7	NA
7/22 - 7/26	1995	7/26	0.4×10^6	9.0	7.3
9/27	1995	9/27	Florida Only	5.6	NA

Figure Captions

Figure 1 Map showing the location of all the IMPROVE fine aerosol monitoring sites in the U.S. that operated for at least one year between 1988 and 1995.

Figure 2 Time series of $PM_{2.5}$ soil concentrations at Virgin Islands National Park from May to September for (a) 1991, (b) 1992, and (c) 1993. ND indicates that no data is available.

Figure 3 Plots showing the $PM_{2.5}$ soil dust concentrations ($\mu g\ m^{-3}$) on (a) 23 June, (b) 26 June, (c) 30 June, (d) 3 July, and (e) 7 July, 1993. Contour lines are shown at 3 and 10 $\mu g\ m^{-3}$ and are dotted in areas where the data is too sparse to permit accurate determination. The black dots indicate sites where the $PM_{2.5}$ soil dust concentration is < 2.0 $\mu g\ m^{-3}$. The soil dust concentration for the Virgin Islands National Park (VI) is also included in the bottom right-hand corner of (a) - (d).

Figure 4 Histogram of the $PM_{2.5}$ soil mass concentrations at all of the IMPROVE sites during the summer of 1993. The median and mean $PM_{2.5}$ soil concentrations are 0.47 and 1.05 $\mu g\ m^{-3}$, respectively.

Figure 5 (a) 10-day isentropic, backward air-mass trajectory (solid line with arrows) originating at Shenandoah National Park at 0000 UT on 7 July, 1993. The arrows indicate the direction that the air parcel actually traveled and are separated by two days. (Trajectory provided by Joyce Harris at NOAA/CMDL)

(b) The altitude of the air parcel on each day of the isentropic, backward air-mass trajectory. (Trajectory provided by Joyce Harris at NOAA/CMDL)

Figure 6 (a) Plot of the average elemental ratios at Virgin Islands National Park (Table 2) versus the average elemental ratios measured at sites in the eastern half of the U.S. with high soil concentrations (Table 2) during the regional dust episode from 23 June - 7 July, 1993. The solid line is the 1:1 line while the dotted line is the least-squares linear regression. The correlation coefficient (R^2) and slope of the linear regression (dashed line) are also included on the left side of the figure.

(b) Same as (a) except that the elemental ratios from the low soil concentration sites in the eastern half of the U.S. (Table 2) are plotted on the vertical ordinate.

Figure 7 Plot of fine soil mass ($PM_{2.5}$) vs. coarse soil mass at Shenandoah National Park (Fig. 1) from March 1993 to March 1994. The concentration of coarse soil was determined from the difference between the 24-hr averaged $PM_{2.5}$ and PM_{10} soil concentrations. Data collected during two regional dust episodes are denoted by solid squares. Linear regressions are included for both normal conditions (solid line) and regional dust events (dotted line).

Figure 8 (a) Monthly averaged $PM_{2.5}$ soil concentration ($\mu g\ m^{-3}$) (open circles) and Al/Ca ratio (solid squares) at Virgin Islands National Park from October 1990 through August 1995.

(b) Histogram of the $PM_{2.5}$ soil concentration ($\mu g\ m^{-3}$) at Virgin Islands National Park for the same time period as (a).

(c) Plot of the Al/Ca ratio versus the $PM_{2.5}$ soil concentration ($\mu g\ m^{-3}$) at Virgin Islands National Park for the same time period as (a). The two solid lines are drawn at a $PM_{2.5}$ soil concentration of 3 $\mu g\ m^{-3}$ and an Al/Ca ratio of 3.8. Data points above and to the right of these two lines are considered to be of North African origin.

Figure 9 (a) Monthly averaged $PM_{2.5}$ soil concentration ($\mu g\ m^{-3}$) (open circles) and Al/Ca ratio (solid squares) at Big Bend National Park (Texas) from March 1988 through November 1995.

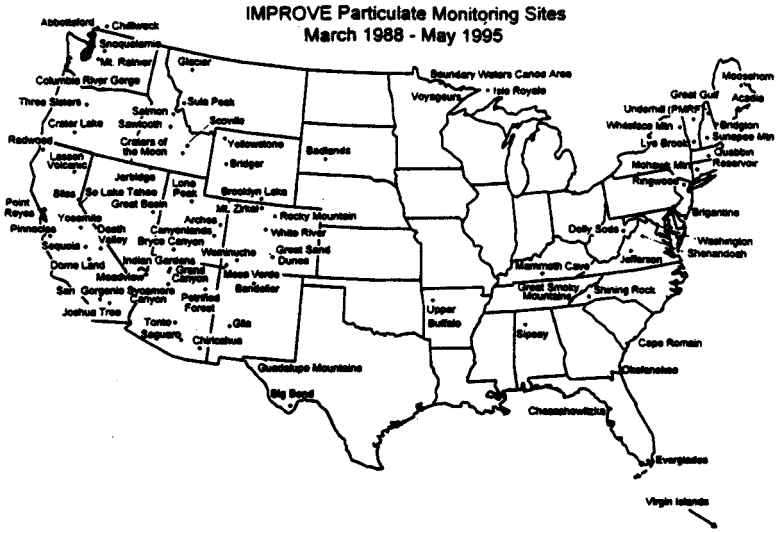
(b) As for (a) except for Guadalupe Mountains National Park (Texas).

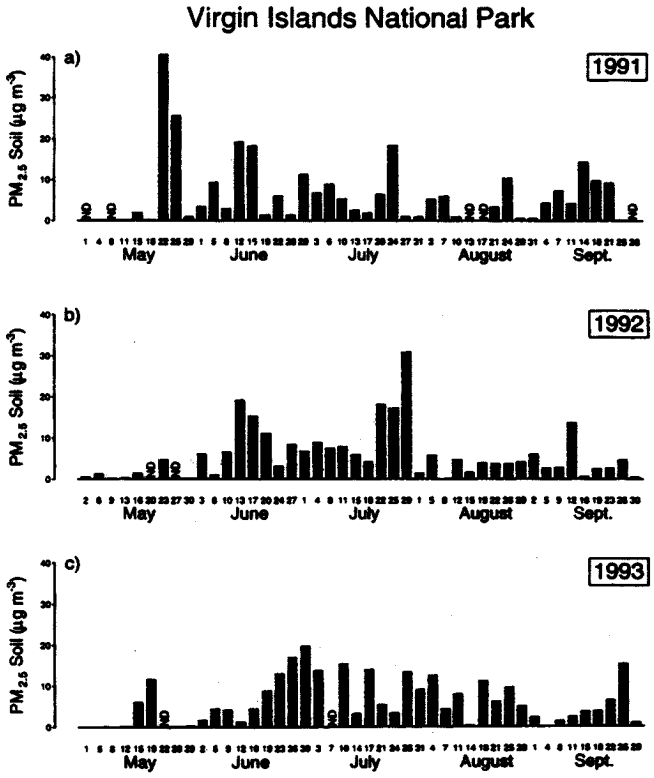
Figure 10 Conceptual model showing how North African dust can be transported into the continental U.S. as it circulates clockwise around the semi-permanent "Bermuda" high pressure zone (H). A westward-shifted "Bermuda" high will increase the likelihood of transport into the central U.S. [This figure is a direct extension of *Rapp*, 1976]

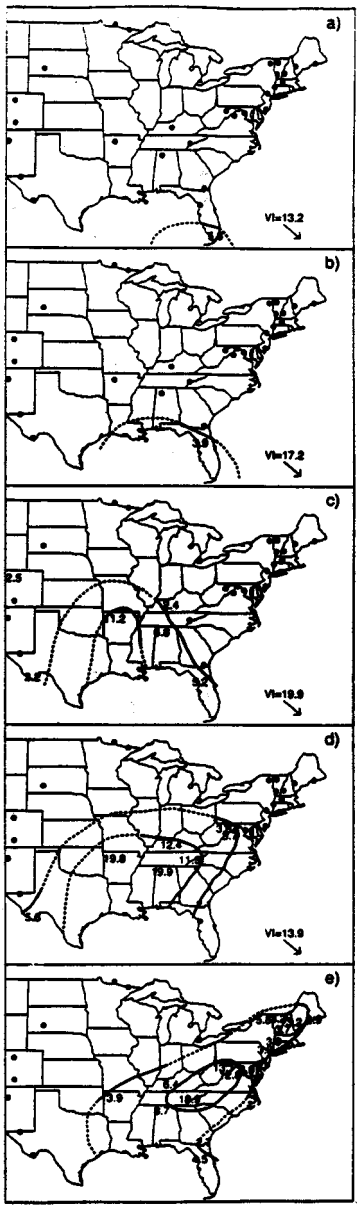
Figure 11 (a) Time series showing the 12-hour averaged $PM_{2.5}$ soil mass concentration ($\mu g\ m^{-3}$) at Great Smoky Mountains National Park during the last two weeks of July, 1995. These data were collected with a standard IMPROVE sampler that was operated daily from 7:00 a.m. to 7:00 p.m. and 7:00 p.m. to 7:00 a.m.

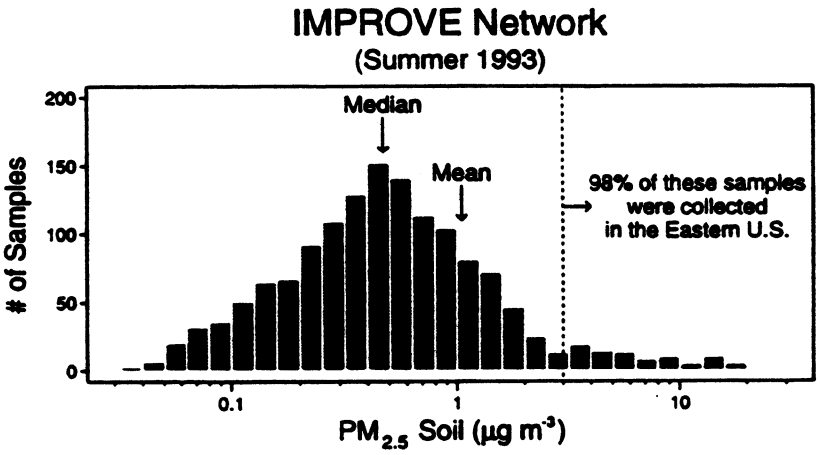
(b) Plot of the Al/Ca ratio versus $PM_{2.5}$ soil concentrations ($\mu g\ m^{-3}$) for the 12-hour averaged data shown in (a). The two solid lines are drawn at a $PM_{2.5}$ soil concentration of 3 $\mu g\ m^{-3}$ and an Al/Ca ratio of 3.8. The four data points above and to the right of these lines occurred on 25 & 26 July and met the two-part North African dust criterion.

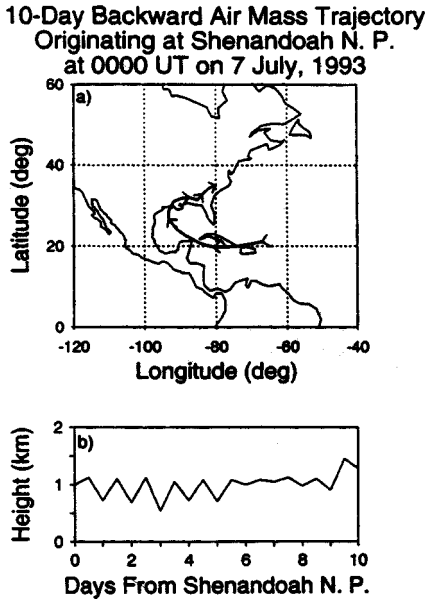
Figure 12 Plot of the average soil mass distribution measured at Great Smoky Mountains National Park on 25 & 26 July, 1995. The data was collected with an 8-stage DRUM impactor that had a cyclone connected to the inlet to remove particles with aerodynamic diameters > 2.5 μm. The concentration of coarse soil was determined from the difference between the 12-hr averaged $PM_{2.5}$ and PM_{10} soil concentrations. The smooth bold line is the inverted mass distribution calculated using the *Twomey* [1975] algorithm. The dotted portion of this line indicates that insufficient data is available to resolve the mass distribution.

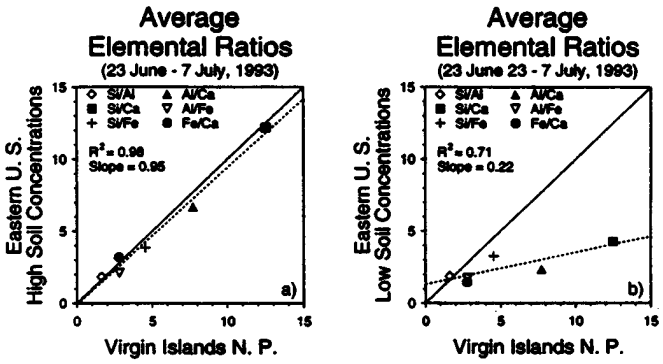

IMPROVE Particulate Monitoring Sites
March 1988 - May 1995
Abbotsford
Chilliwack
Snoqualmie
Mt. Rainier
Columbia River Gorge
Three Sisters
Crater Lake
Redwood
Lassen Volcanic
Point Reyes
Pinnacles
Sequoia
Dome Land
San Gorgonio
Joshua Tree
Glacier
Sula Peak
Salmon
Sawtooth
Craters of the Moon
Scoville
Yellowstone
Bridger
Badlands
Jarbidge
Lone Peak
Brooklyn Lake
Bliss
So Lake Tahoe
Great Basin
Mt. Zirkel
Rocky Mountain
Yosemite
Death Valley
Arches
Canyonlands
Bryce Canyon
White River
Indian Gardens
Grand Canyon
Weminuche
Great Sand Dunes
Meadview
Mesa Verde
Bandelier
Sycamore Canyon
Petrified Forest
Tonto
Saguaro
Gila
Chiricahua
Guadalupe Mountains
Big Bend
Boundary Waters Canoe Area
Voyageurs
Isle Royale
Upper Buffalo
Mammoth Cave
Great Smoky Mountains
Shining Rock
Sipsey
Cape Romain
Okefenokee
Chassahowitzka
Everglades
Virgin Islands
Moosehorn
Acadia
Great Gulf
Underhill (PMRF)
Whiteface Mtn
Bridgton
Sunapee Mtn
Lye Brook
Quabbin Reservoir
Mohawk Mtn
Ringwood
Brigantine
Dolly Sods
Washington
Shenandoah
Jefferson

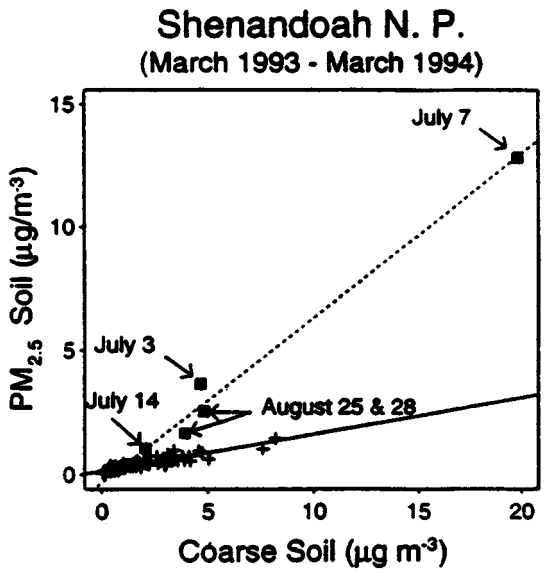

Virgin Islands National Park
a)
1991
b)
1992
c)
1993
PM2.5 Soil (µg m-3)
May
June
July
August
Sept.

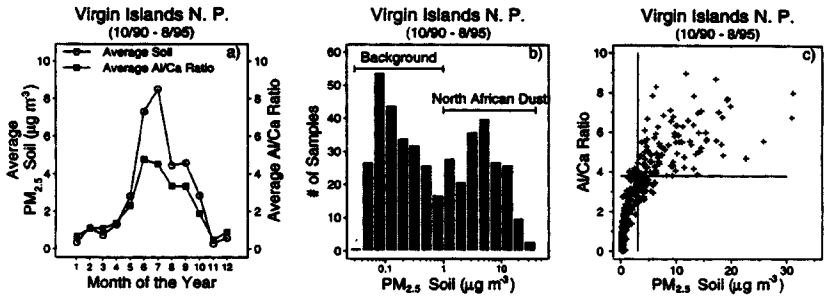

a)
Vt=13.2
b)
Vt=17.2
c)
Vt=19.9
d)
Vt=13.9
e)

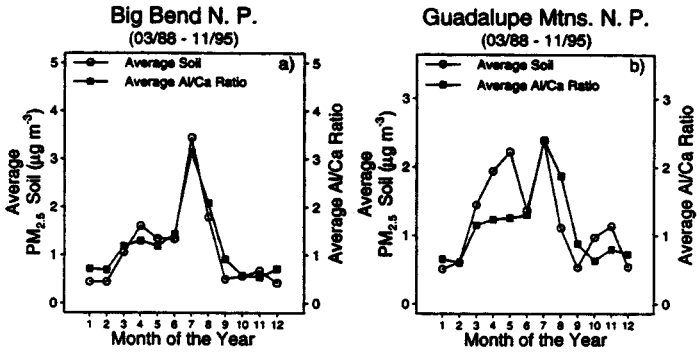

IMPROVE Network
(Summer 1993)
Median
Mean
98% of these samples were collected in the Eastern U.S.
# of Samples
200
150
100
50
0
0.1
1
10
PM2.5 Soil (µg m-3)

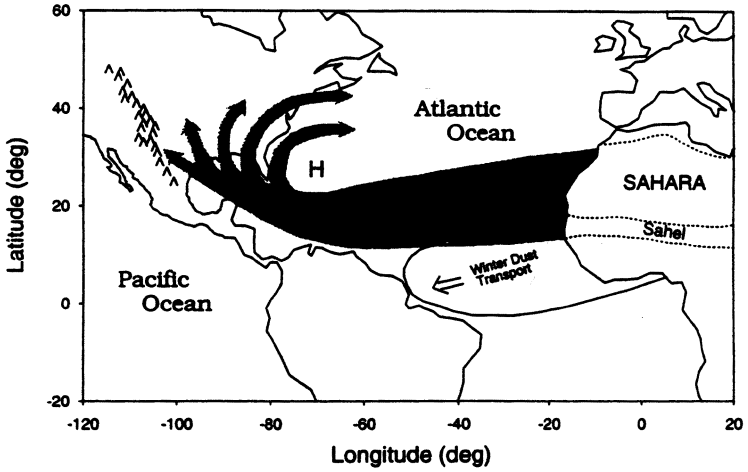

10-Day Backward Air Mass Trajectory
Originating at Shenandoah N. P.
at 0000 UT on 7 July, 1993
a)
Latitude (deg)
60
40
20
0
-120
-100
-80
-60
-40
Longitude (deg)
b)
Height (km)
2
1
0
0
2
4
6
8
10
Days From Shenandoah N. P.

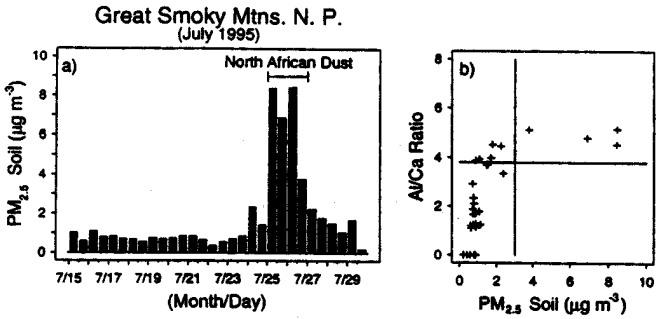

Average
Elemental Ratios
(23 June - 7 July, 1993)
Si/Al
Al/Ca
Si/Ca
Al/Fe
Si/Fe
Fe/Ca
R^2 = 0.98
Slope = 0.95
a)
Eastern U. S.
High Soil Concentrations
Virgin Islands N. P.
Average
Elemental Ratios
(23 June 23 - 7 July, 1993)
Si/Al
Al/Ca
Si/Ca
Al/Fe
Si/Fe
Fe/Ca
R^2 = 0.71
Slope = 0.22
b)
Eastern U. S.
Low Soil Concentrations
Virgin Islands N. P.

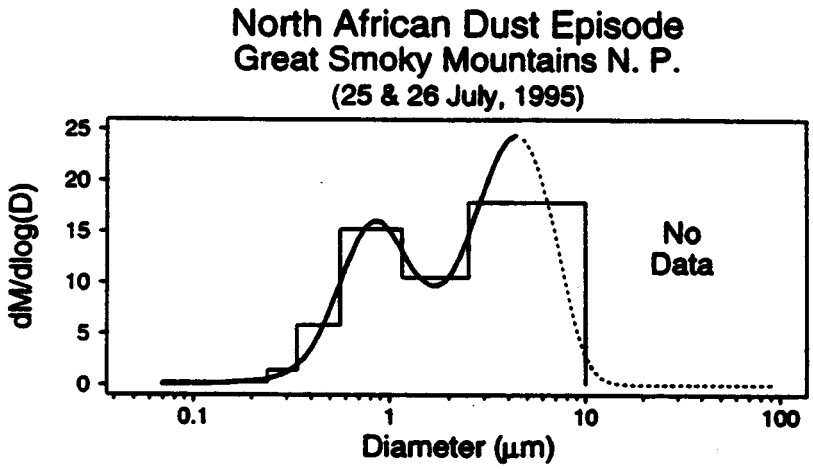

Shenandoah N. P.
(March 1993 - March 1994)
July 7
July 3
July 14
August 25 & 28
PM2.5 Soil (µg/m-3)
Coarse Soil (µg m-3)
0
5
10
15
20


Virgin Islands N. P.
(10/90 - 8/95)
Average Soil
Average Al/Ca Ratio
a)
Average PM2.5 Soil (µg m-3)
Average Al/Ca Ratio
Month of the Year
Virgin Islands N. P.
(10/90 - 8/95)
Background
North African Dust
b)
# of Samples
PM2.5 Soil (µg m-3)
Virgin Islands N. P.
(10/90 - 8/95)
c)
Al/Ca Ratio
PM2.5 Soil (µg m-3)


Big Bend N. P.
(03/88 - 11/95)
Average Soil
Average Al/Ca Ratio
a)
Average PM2.5 Soil (µg m-3)
Average Al/Ca Ratio
Month of the Year
Guadalupe Mtns. N. P.
(03/88 - 11/95)
Average Soil
Average Al/Ca Ratio
b)
Average PM2.5 Soil (µg m-3)
Average Al/Ca Ratio
Month of the Year


Atlantic
Ocean
H
SAHARA
Sahel
Winter Dust
Transport
Pacific
Ocean
Latitude (deg)
Longitude (deg)
60
40
20
0
-20
-120
-100
-80
-60
-40
-20
0
20


Great Smoky Mtns. N. P.
(July 1995)
a)
North African Dust
PM2.5 Soil (µg m-3)
7/15 7/17 7/19 7/21 7/23 7/25 7/27 7/29
(Month/Day)
b)
Al/Ca Ratio
PM2.5 Soil (µg m-3)


North African Dust Episode
Great Smoky Mountains N. P.
(25 & 26 July, 1995)
dM/dlog(D)
25
20
15
10
5
0
0.1
1
10
100
Diameter (µm)
No
Data

From the Federal Register

Comments on Coarse Particles

Part II (Proposed Standards)

Page 65644

The 1982 Staff Paper (U.S. EPA, 1982b) summarized qualitative evidence for morphometric changes associated with long-term exposure to crustal dusts, as suggested by autopsy studies of humans and animals exposed to various crustal dusts near or slightly above current ambient levels in the Southwest; however, no inferences regarding quantitative exposures of concern can be drawn from these studies.

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By contrast, the current review finds much less direct epidemiological or toxicological evidence regarding the potential effects of coarse fraction particles at typical ambient concentrations.

On the other hand, both past and current reviews of occupational and toxicological literature have found ample qualitative reasons for concern about higher-than-ambient concentrations of coarse fraction particles. At such elevated levels, coarse fraction particles are linked to short-term effects such as aggravation of asthma and increased upper respiratory illness, which are consistent with enhanced deposition of coarse fraction particles in the tracheobronchial region (U.S. EPA, 1996a, p. 13-51). Children may be particularly sensitive to such an effect, since they typically spend more time in outdoor activities, such that they may encounter higher exposures and doses of coarse fraction particles than other potentially sensitive populations.

In addition, long-term deposition of insoluble coarse fraction particles in the alveolar region may have the potential for enhanced toxicity, in part because clearance from this region of the lung is significantly slower than from the tracheobronchial region. Limited qualitative support for this concern is found in autopsy studies of animals and humans exposed to various ambient crustal dusts at or slightly above ambient levels typical in the Southwest.

Unlike the case for fine particles, the clearest community epidemiological evidence regarding coarse fraction particles finds such effects only in areas with numerous marked exceedances of the current PM_{10} standard (U.S. EPA, 1996a, p. 13-51). In this regard, it appears that the weight of the available evidence allowing direct comparisons between the two size fractions of PM_{10} suggests that ambient coarse fraction particles are either less potent or a poorer surrogate for community effects of air pollution than are fine fraction particles.

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In this regard, the Criteria Document concludes that fine and coarse fractions of PM_{10} should be considered separately (U.S. EPA, 1996a, p. 13-93). Taking into account such information, CASAC found sufficient scientific and technical bases to support establishment of separate standards relating to these two fractions of PM_{10}. Specifically, CASAC advised the

Administrator that ``there is a consensus that retaining an annual $PM_{10}$ NAAQS * * * is reasonable at this time" and that there is ``also a consensus that a new $PM_{2.5}$ NAAQS be established" (Wolff, 1996b).

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2. Indicators for the Coarse Fraction of PM_{10}

The Criteria Document and Staff Paper conclude that epidemiological information, together with dosimetry and toxicological information, support the need for a particle indicator that addresses the health effects associated with coarse fraction particles within PM_{10} (i.e., $PM_{10-2.5}$). As noted above, coarse fraction particles can deposit in those sensitive regions of the lung of most concern. Although the role of coarse fraction particles in much of the recent epidemiological results is unclear, limited evidence from studies where coarse fraction particles are the dominant fraction of PM_{10} suggest that significant short-term effects related to coarse fraction particles include aggravation of asthma and increased upper respiratory illness. In addition, qualitative evidence suggests potential chronic effects associated with long-term exposure to high concentrations of coarse fraction particles.

In selecting an indicator for coarse fraction particles, the Administrator took into account the views of several CASAC panel members who suggested using the coarse fraction directly (i.e., $PM_{10-2.5}$) as the indicator. However, the Administrator notes that the existing ambient data base for coarse fraction particles is smaller than that for fine particles, and that the only studies of clear quantitative relevance to effects most likely associated with coarse fraction particles have used undifferentiated PM_{10}. In fact, it was the consensus of CASAC that it is reasonable to consider PM_{10} itself as a surrogate for coarse fraction particles, when used in conjunction with $PM_{2.5}$ standards. The monitoring network already in place for PM_{10} is large. Therefore, in conjunction with the decision to have separate standards for $PM_{2.5}$, the Administrator concludes, consistent with CASAC recommendations, that it is appropriate to retain PM_{10} as the particle indicator for standards intended to protect against the effects most likely associated with coarse fraction particles.

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Based on assessments of the available information in the Criteria Document and Staff Paper, both the staff and CASAC recommended retention of an annual PM_{10} standard. The staff, with CASAC concurrence, recommended retention of the current expected annual mean form of the standard, which is the same form being proposed for the annual $PM_{2.5}$ standard. As noted in the staff assessment, the current annual PM_{10} standard offers substantial protection against both long- and short-term effects of coarse fraction particles.

The staff and CASAC also recommended that consideration be given to retention of a 24-hour standard to provide additional protection against potential effects of short-term exposures to coarse fraction particles. The staff, with CASAC concurrence, also recommended that if a 24-hour standard is retained, the form of the standard should be revised to provide a more robust

target for practical coarse particle controls. For the reasons outlined above regarding the form of the 24-hour $PM_{2.5}$ standard, the Administrator believes the 98th percentile concentration based form would also be an appropriate form for a 24-hour PM_{10} standard.

2. Levels for Alternative Averaging Times

a. Annual PM_{10} Standard

Taking into account the above considerations, as more fully detailed in the Staff Paper and the CASAC recommendations, the Administrator proposes to retain the current annual PM_{10} standard of 50 $\mu g/m^3$ to protect against the long- and short-term effects of coarse fraction particles.

b. 24-Hour PM_{10} Standard

As discussed above, EPA staff and CASAC also recommended that consideration should be given to a 24-hour standard for coarse fraction particles as measured by PM_{10}. Unlike the case for the annual standard, however, the staff found that the original quantitative basis for the level of the current 24-hour PM_{10} standard (150 $\mu g/m^3$) is no longer appropriate. Instead, the staff found the main quantitative basis for a short-term standard is provided by the two community studies of exposure to fugitive dust referenced above. Because these studies reported multiple large [[Page 65662]] exceedences of the current 24-hour standard, and because of limitations in the studies themselves, they provide no basis to lower the level of the standard below 150 $\mu g/m^3$. Moreover, none of the qualitative literature regarding the potential short-term effects of coarse particles provides a basis for a lower standard level. Both EPA staff and CASAC recommended that if a 24-hour PM_{10} standard is retained, the level of the standard should be maintained at 150 $\mu g/m^3$, although with a revised form.

In the judgment of the Administrator, retention of a 24-hour PM_{10} standard at the level of 150 $\mu g/m^3$ with a 98th percentile form would provide adequate protection against the short-term effects of coarse particles that have been identified to date in the scientific literature. However, analyses of the available air quality relationships show that such a standard might not add greatly to the protection afforded by the current PM_{10} annual standard (Fitz-Simons et al., 1996). As noted in the Staff Paper and by some CASAC panel members, it is possible that the current annual standard might provide adequate protection against both long- and short-term effects of coarse particles, especially when viewed in conjunction with the overall proposal to add new annual and 24-hour $PM_{2.5}$ standards. Therefore, the Administrator also solicits comment on the alternative of retaining the current annual PM_{10} standard and revoking the current 24-hour PM_{10} standard.

National Ambient Air Quality Standards for Particulate Matter

(For references to IMPROVE see pages 10-12)

Part II SUMMARY:

With respect to PM, EPA proposes to revise the current primary PM_{10} standards by adding two new primary $PM_{2.5}$ standards set at 15 $\mu g/m^3$, annual mean, and 50 $\mu g/m^3$, 24-hour average, to provide increased protection against a wide range of PM-related health effects, including premature mortality and increased hospital admissions and emergency room visits (primarily in the elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (in children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms. The proposed annual $PM_{2.5}$ standard would be based on the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations, spatially averaged across an area. The proposed 24-hour $PM_{2.5}$ standard would be based on the 3-year average of the 98th percentile of 24-hour $PM_{2.5}$ concentrations at each monitor within an area. The EPA also solicits comment on two alternative approaches for selecting the levels of $PM_{2.5}$ standards. The EPA proposes to revise the current 24-hour primary PM_{10} standard of 150 $\mu g/m^3$ by replacing the 1-expected-exceedance form with a 98th percentile form, averaged over 3 years at each monitor within an area, and solicits comment on an alternative proposal to revoke the 24-hour PM_{10} standard. The EPA also proposes to retain the current annual primary PM_{10} standard of 50 $\mu g/m^3$. Further, EPA proposes new data handling conventions for calculating 98th percentile values and spatial averages (Appendix K), proposes to revise the reference method for monitoring PM as PM_{10} (Appendix J), and proposes a new reference method for monitoring PM as $PM_{2.5}$ (Appendix L).

The EPA proposes to revise the current secondary standards by making them identical to the suite of proposed primary standards. In the Administrator's judgment, these standards, in conjunction with the establishment of a regional haze program under section 169A of the Act, would provide appropriate protection against PM-related public welfare effects including soiling, material damage, and visibility impairment.

The principal focus of this current review of the air quality criteria and standards for PM is on recent epidemiological evidence reporting associations between ambient concentrations of PM and a range of serious health effects. In the judgment of the Administrator, this intensive evaluation of the scientific evidence has provided an adequate basis for regulatory decision making at this time, as well as for the comprehensive research plan recently developed by EPA, and reviewed by CASAC and others, for improving our future understanding of the relationships between ambient PM exposures and health effects.

Based on atmospheric chemistry, exposure, and mechanistic considerations, the Criteria Document concludes it would be most appropriate to ``consider fine and coarse mode particles as separate subclasses of pollutants" While components of both fractions can produce health

effects, in general the fine fraction appears to contain more of the reactive substances potentially linked to the kinds of effects observed in the epidemiological studies.

1. Indicators for the Fine Fraction of PM_{10}

The Administrator concludes that it is appropriate to control fine particles as a group, as opposed to singling out particular components or classes of fine particles.

2. Indicators for the Coarse Fraction of PM_{10}

The Administrator concludes, consistent with CASAC recommendations, that it is appropriate to retain PM_{10} as the particle indicator for standards intended to protect against the effects most likely associated with coarse fraction particles.

E. Averaging Time of $PM_{2.5}$ Standards

The Administrator has concluded that a short-term $PM_{2.5}$ standard with a 24-hour averaging time can serve to control short-term ambient $PM_{2.5}$ concentrations, thus providing protection from health effects associated with short-term (from less than 1-day to up to 5-day) exposures to $PM_{2.5}$.

The Administrator has concluded that a long-term $PM_{2.5}$ standard with an annual averaging time can serve to control both long- and short-term ambient $PM_{2.5}$ concentrations, thus providing protection from health effects associated with long-term (seasonal to several years) and, to some degree, short-term exposures to $PM_{2.5}$.

The Administrator believes that the suite of $PM_{2.5}$ standards can be most effectively and efficiently defined by treating the annual standard as the generally controlling standard for lowering both short- and long-term $PM_{2.5}$ concentrations. As a supplement to the annual standard, the 24-hour standard would serve as a backstop to provide additional protection against days with high peak $PM_{2.5}$ concentrations, localized ``hot spots," and risks arising from seasonal emissions that would not be well controlled by a national annual standard.

The Administrator concurs with the Staff Paper recommendation, supported by CASAC, to use the 3-year average annual arithmetic mean as the form for an annual $PM_{2.5}$ standard, consistent with the current form of the annual PM_{10} standard.

The Staff Paper and some CASAC panel members also recommended that consideration be given to calculating the $PM_{2.5}$ annual arithmetic mean for an area by averaging the annual arithmetic means derived from multiple, primarily population-oriented monitoring sites within a monitoring planning area.

The Administrator believes that a 98th percentile value form of a standard, set at an appropriate level, would achieve the desired outcomes of both a 24-hour standard that would serve as an effective supplement to the $PM_{2.5}$ annual standard and a more stable form.

Taking the epidemiological studies of both short- and long-term exposures together, the Administrator believes the concordance of evidence for PM effects and associated levels provides clear support for an annual $PM_{2.5}$ standard level of about 15 $\mu g/m^3$.

The Administrator is mindful, however, that in assessing these factors a series of judgments had to be made with respect to both the interpretation of the underlying scientific evidence and the treatment of inherent uncertainties and limitations in the available information in making policy choices. Accordingly, the Administrator solicits broad public comment, not only on her proposed decision to establish new $PM_{2.5}$ standards of 15 $\mu g/m^3$, annual average, and 50 $\mu g/m^3$, 24-hour average, but also on the two alternative approaches described above. Based on the comments received and the accompanying rationale, the Administrator may choose at the time of final promulgation to adopt other standards within the range of these alternative approaches in lieu of the standards she is proposing today.

The Administrator proposes to retain the current annual PM_{10} standard of 50 $\mu g/m^3$ to protect against the long- and short-term effects of coarse fraction particles.

In the judgment of the Administrator, retention of a 24-hour PM_{10} standard at the level of 150 $\mu g/m^3$ with a 98th percentile form would provide adequate protection against the short-term effects of coarse particles that have been identified to date in the scientific literature. However, analyses of the available air quality relationships show that such a standard might not add greatly to the protection afforded by the current PM_{10} annual standard (Fitz-Simons et al., 1996). As noted in the Staff Paper and by some CASAC panel members, it is possible that the current annual standard might provide adequate protection against both long- and short-term effects of coarse particles, especially when viewed in conjunction with the overall proposal to add new annual and 24-hour $PM_{2.5}$ standards. Therefore, the Administrator also solicits comment on the alternative of retaining the current annual PM_{10} standard and revoking the current 24-hour PM_{10} standard.

A. Visibility Impairment

This section of the notice presents the Administrator's proposed decision to address the effects of PM on visibility by setting secondary standards identical to the suite of proposed primary standards, in conjunction with the establishment of a regional haze program under section 169A of the Act. In the Administrator's judgment, this approach is the most effective way to address visibility impairment given the sharp regional variations in concentrations of non-anthropogenic PM as well as other factors (e.g., humidity) that affect visibility. By augmenting the protection provided by secondary standards set identical to the proposed suite of primary standards with a regional haze program, the Administrator believes that an appropriate degree of visibility protection can be achieved in the various regions of the country.

Based on the foregoing, the Administrator concludes that attainment of secondary standards set at the level of the proposed primary standards for $PM_{2.5}$ would be expected to result in visibility improvements in the eastern U.S. at both urban and regional scales, but little or no change in the western U.S. except in and near selected urban areas.

Because of these regional differences, it is the Administrator's judgment that national secondary standards intended to maintain or improve visibility conditions on the Colorado Plateau would have to be set at or even below natural background levels in the East, the attainment of which would effectively require elimination of all eastern anthropogenic emissions. Conversely, national secondary standards that would achieve an appropriate degree of visibility improvement in the East would permit further degradation in the West. Due to this regional variability in visibility conditions created by differing background fine particle levels and the effect of humidity on these background levels, the Administrator concludes that proposing more stringent national secondary standards would not be an effective or appropriate means to protect the public welfare from adverse impacts of PM on visibility in all parts of the country.

PART 50--NATIONAL PRIMARY AND SECONDARY AMBIENT AIR QUALITY STANDARDS

2. Sec. 50.3 Reference conditions.

All measurements of air quality that are expressed as mass per unit volume (e.g., $\mu g/m^3$) other than for particulate matter (PM_{10} and $PM_{2.5}$) shall be corrected to a reference temperature of 25 °C and a reference pressure of 760 millimeters of mercury (1,013.2 millibars). Measurements of PM_{10} and $PM_{2.5}$ shall be reported based on actual air volume measured at the actual temperature and pressure at the monitoring site during the measurement period.

3. Sec. 50.6 National primary and secondary ambient air quality standards for particulate matter.

(a) The national primary and secondary ambient air quality standards for particulate matter are:

(1) 15.0 $\mu g/m^3$ annual arithmetic mean concentration, and 50 $\mu g/m^3$ 24-hour average concentration measured in the ambient air as $PM_{2.5}$ (particles with an aerodynamic diameter less than or equal to a nominal 2.5 μm).

(2) 50 $\mu g/m^3$ annual arithmetic mean concentration, and 150 $\mu g/m^3$ 24-hour average concentration measured in the ambient air as PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 μm).

(b) The annual primary and secondary $PM_{2.5}$ standards are met when the annual arithmetic mean concentration, as determined in accordance with Appendix K to this part, is less than or equal to 15.0 $\mu g/m^3$.

(c) The 24-hour primary and secondary $PM_{2.5}$ standards are met when the 98th percentile 24-hour concentration, as determined in accordance with Appendix K to this part, is less than or equal to 50 $\mu g/m^3$.

(d) The annual primary and secondary PM_{10} standards are met when the annual arithmetic mean concentration, as determined in accordance with Appendix K of this part, is less than or equal to 50 $\mu g/m^3$.

(e) The 24-hour primary and secondary PM_{10} standards are met when the 98th percentile 24-hour concentration, as determined in accordance with Appendix K of this part, is less than or equal to 150 $\mu g/m^3$.

2.0 Comparisons With the $PM_{2.5}$ Standards

2.1 Annual $PM_{2.5}$ Standard

The annual $PM_{2.5}$ standard is met when the 3-year average of the spatially averaged annual means is less than or equal to 15.0 $\mu g/m^3$. The 3-year average of the spatially averaged annual means is determined by averaging quarterly means at each monitor to obtain the annual mean $PM_{2.5}$ concentrations at each monitor, then averaging across all designated monitors, and finally averaging for three consecutive years.

The steps can be summarized as follows:
(a) Average 24-hour measurements to obtain quarterly means at each monitor,
(b) Average quarterly means to obtain annual means at each monitor,
(c) Average across designated monitoring sites to obtain an annual spatial mean for an area, and
(d) Average 3 years of annual spatial means to obtain a 3-year average of spatially averaged annual means.

For the annual $PM_{2.5}$ standard, a year meets data completeness requirements when at least 75 percent of the scheduled sampling days for each quarter have valid data. Three years of spatial averages are required to demonstrate that the standard has been met. Sites with less than 3 years of data shall be included in spatial averages for those years that data completeness requirements are met. The formulas for calculating the 3-year average annual mean of the $PM_{2.5}$ standard are given in Section 2.5.

Although 3 complete years of data are required to demonstrate that the standard has been met, years with high concentrations shall not be ignored just because they have less than complete data. Thus, in computing annual spatially averaged means, sites with less than 75 percent data completeness for each quarter in a year shall be included in the computation if the resulting annual mean concentration is greater than the level of the standard.2.2 24-Hour $PM_{2.5}$ Standard

The 24-hour $PM_{2.5}$ standard for is met when the 3-year average of the 98th percentile values at each monitoring site is less than or equal to 50 $\mu g/m^3$. This comparison shall be based on three consecutive, complete years of air quality data. A year meets data completeness criteria when at least 75 percent of the scheduled sampling days have valid data for each quarter. The formula for calculating the 3-year average of the annual 98th percentile values is given in Section 2.6.

Although three complete years of data are required to demonstrate that the standard has been met, years with high concentrations shall not be ignored just because they have less than complete data. Thus, in computing the 3-year average 98th percentile value, years with less than 75 percent data completeness shall be included in the computation if the annual 98th percentile value is greater than the level of the standard.

3.0 Comparisons with the PM_{10} Standards3.1 Annual PM_{10} Standard

The annual PM_{10} standard is met when the 3-year average of the annual mean PM_{10} concentrations at each monitoring site is less than or equal to 50 $\mu g/m^3$. The 3-year average of the annual means is determined by averaging quarterly means to obtain annual mean PM_{10} concentrations for 3 consecutive, complete years at each monitoring site. The steps can be summarized as follows:
(a) Average 24-hour measurements to obtain a quarterly mean,
(b) Average quarterly means to obtain an annual mean, and
(c) Average annual means to obtain a 3-year mean.

For the annual PM_{10} standard, a year meets data completeness requirements when at least 75 percent of the scheduled sampling days for each quarter have valid data. The formulas for calculating the 3-year average annual mean of the PM_{10} standard are given in Section 3.5.

Although 3 complete years of data are required to demonstrate that the standard has been met, years with high concentrations shall not be ignored just because they have less than complete data. Thus, in computing the 3-year average annual mean concentration, years with less than 75 percent data completeness shall be included in the computation if the annual mean concentration is greater than the level of the standard.3.2 24-Hour PM_{10} Standard

The 24-hour PM_{10} standard is met when the 3-year average of the annual 98th percentile values at each monitoring site is less than or equal to 150 $\mu g/m^3$. This comparison shall be based on 3 consecutive, complete years of air quality data. A year meets data completeness criteria when at least 75 percent of the scheduled sampling days have valid data each quarter. The formula for calculating the 3-year average of the annual 98th percentile values is given in Section 3.6.

Although 3 complete years of data are required to demonstrate that the standard has been met, years with high concentrations shall not be ignored just because they have less than complete data. Thus, in computing the 3-year average of the annual 98th percentile values, years with less than 75 percent data completeness shall be included in the computation if the annual 98th percentile value is greater than the level of the standard.

7.0 $PM_{2.5}$ Sampler.

7.1 Configuration. The sampler shall consist of a sample air inlet, downtube, particle size separator (impactor), filter holder assembly, air pump and flow rate control system, flow rate measurement device, ambient and filter temperature monitoring system, timer, outdoor environmental enclosure, and suitable mechanical, electrical, or electronic control capability to

provide the design and functional performance as specified in this section 7. The performance specifications require that the sampler:
(a) provide automatic control of sample flow rate and other operational parameters,
(b) monitor these operational parameters as well as ambient temperature and pressure, and
(c) provide this information to the sampler operator at the end of each sample period in digital form, either visually or as electronic data available for output through a data output port connection.

7.4.1 Sample flow rate. Proper operation of the impactor requires that specific air velocities be maintained through the device. Therefore, the sample air flow rate through the inlet, downtube, impactor, and filter shall be 16.67 L/min (1.000 m^3/hour) ± 5%, measured as actual volumetric flow rate at the temperature and pressure of the sample air entering the impactor.

7.4.4 Flow rate cut off. The sampler's sample air flow rate control system shall terminate sample collection and stop all sample flow for the remainder of the sample period in the event that the sample flow rate deviates by more than 10 percent from the nominal (or cumulative average) sampler flow rate specified in section 7.4.1 for more than 60 seconds. However, this sampler cut-off provision shall not apply during periods when the sampler is inoperative due to a temporary power interruption and the elapsed time of the inoperative period will not be included in the total sample time measured and reported by the sampler (see section 7.4.13).

7.4.5 Flow rate measurement.

7.4.5.1 The sampler shall provide a means to measure and indicate the instantaneous sample air flow rate, which shall be measured as volumetric flow rate at the temperature and pressure of the sample air entering the impactor, with an accuracy of ± 2 percent. The sampler shall also provide a simple means by which the sampler operator can manually start the sample flow temporarily during non-sampling modes of operation, for the purpose of checking the sample flow rate or the flow rate measurement system.

7.4.5.2 During each sample period, the sampler's flow rate measurement system shall automatically monitor the sample volumetric flow rate, obtaining flow rate or average flow rate measurements at intervals of not greater than 5 minutes.

8.1 Analytical balance. The analytical balance used to weigh filters must be suitable for weighing the type and size of filters specified (section 6) and have a readability of ± 1 μg. The balance shall be calibrated as specified by the manufacturer at installation and recalibrated immediately prior to each weighing session, but not less often than once per year. See Reference 2 for additional guidance.

8.2 Filter conditioning/equilibration. All filters used are to be conditioned or equilibrated immediately before both the pre- and post-sampling weighings as specified below. See Reference 2 for additional guidance.

8.2.1 Mean temperature: 20-23 °C.

8.2.2 Temperature control: ± 2 °C over 24 hours.

8.2.3 Mean humidity: 30-40 percent relative humidity.

8.2.4 Humidity control: ± 5 relative humidity percent over 24 hours.

8.2.5 Conditioning time: not less than 24 hours.

8.3 Weighing procedure.

8.3.1 New filters should be placed in the conditioning environment immediately upon arrival and stored there until the pre-sampling weighing. See Reference 2 for additional guidance.

8.3.2 The analytical balance shall be located in the same environment in which the filters are conditioned or equilibrated, such that the filters can be weighed immediately following the conditioning period without intermediate or transient exposure to nonequilibration conditions.

8.3.3 Filters must be equilibrated at the same conditions before both the pre- and post-sampling weighings.

8.3.4 Both the pre- and post-sampling weighings should be carried out by the same analyst on the same analytical balance, using an effective technique to neutralize static charges on the filter.

8.3.5 The pre-sampling (tare) weighing shall be within 30 days of the sampling period.

8.3.6 The post-sampling equilibration and weighing shall be completed within 240 hours (10 days) after the end of the sample period.

8.3.7 New blank filters shall be weighed along with the pre-sampling (tare) weighing of each lot of $PM_{2.5}$ filters. These blank filters shall be transported to the sampling site, installed in the sampler, retrieved from the sampler without sampling, and reweighed as a quality control check.

10.17 Filter archiving. Following the post-sampling weighing or other non-destructive analysis, air pollution control agencies shall archive all routinely collected $PM_{2.5}$ filter samples from all SLAMS sites, as well as appropriate, associated laboratory and field blanks and other quality assurance replicate samples, for a period of not less than 1 year after collection. All $PM_{2.5}$ filters from core NAMS sites shall be archived for a period of not less than 5 years after collection. These archived filters shall be made available for supplemental analyses at the request of the EPA or to provide information to State and local agencies on the composition and trends for $PM_{2.5}$. Archived filter samples shall be stored in clean, dust-proof, covered containers at a temperature of 4 ± 3 °C; see Reference 2 for additional guidance.

Part VI

B. Section 58.13--Operating Schedule

2. $PM_{2.5}$ Sampling. Core $PM_{2.5}$ SLAMS (including NAMS and Core SLAMS collocated at PAMS sites) would be required to sample every day, unless an exception is approved by EPA during established seasons of low PM pollution during which time a minimum of once in 6 days sampling would be permitted. Non-core SLAMS sites would generally be required to sample a minimum of once every sixth day, although episodic or seasonal sampling could also be possible (e.g., in areas where significant violations of the 24-hour NAAQS are expected or at sites heavily influenced by regional transport or episodic conditions). Special purpose monitors, however, may sample on any sampling schedule.

There is currently very little $PM_{2.5}$ measurement data. New networks must be established as expeditiously as possible to help characterize the nature and extent of $PM_{2.5}$ ambient air quality nationwide. Daily sampling for $PM_{2.5}$ is especially important during the first few years of the new $PM_{2.5}$ monitoring program to allow for the collection of complete sets of data in order to help with identifying temporal patterns and to understand the episodic behavior of fine particles.

Although daily sampling with manual methods is labor intensive due to site visits and filter equilibration and weighing, semi-automatic sequential samplers are anticipated to be approvable as class I equivalent samplers (under the provisions of Part 53) which will simplify the data collection process. The EPA solicits comments on the need to extend the start date for a requirement to perform everyday sampling until the time when Class I equivalent samplers have been approved by the Agency.

The EPA Reference Method documents have the following references to IMPROVE. I have added **bold-face** to the key sentences. I dropped a few insignificant references.

Part V - Implementation

What are the relative contributions of primary and secondary organic aerosols across varying spatial (and time) scales? The potential for large secondary organic aerosol production from biogenic sources (e.g., pinene emissions) exists throughout the East. How significant are biogenic-derived aerosols compared to local/urban contributions from primary anthropogenic organic aerosols? How different are these relative contributions across seasons, given that secondary organic aerosol formation increases during the summer? Many uncertainties underlie the integration of primary and secondary particles, aside from integrating particles and ozone. For instance, what are the interactive roles exerted by elemental carbon emissions and other products of incomplete combustion and geologic materials in both primary contribution to PM and as formation nuclei for highly complex secondary PM? On balance, the ability to perform ozone air quality assessments far exceeds that of fine particles. **However, the infrastructure for conducting fine particle analyses appears to be in place** as a result of progress gained from ozone and acid deposition modeling and existing monitoring programs for ozone and visibility (i.e., **the Interagency Monitoring of Protected Visual Environments (IMPROVE) program**). Finally, although uncertainties remain in transforming particles into visibility impairment within short averaging times, **the IMPROVE methodologies for particle and visibility measurements (and the relationships between particles and visibility) are widely accepted.**

Question: **Should reasonable progress be demonstrated on a ``regional'' basis (i.e., for groups of Federal Class I areas), with certain IMPROVE sites deemed representative of others lacking monitoring?**

Issue: Monitoring Program--Since 1987, EPA has supported the IMPROVE network in cooperation with the National Park Service, other FLM's, and State organizations. The IMPROVE network employs aerosol, optical (i.e., nephelometers and transmissometers) and scene (i.e., 35 mm photography) measurements. Direct measurements are taken of fine particles and precursors that contribute to visibility impairment at more than 40 mandatory Federal Class I areas across the country. Aerosol measurements are taken twice a week for PM-10 and fine particle masses and for key constituents of fine particles, such as sulfate, nitrate, organic and elemental carbon, soil dust, and several other elements. Measurements for specific aerosol constituents are used to calculate ``reconstructed'' aerosol light extinction by multiplying the mass for each constituent by its empirically-derived scattering and/or absorption efficiency. These reconstructed light extinction levels are cross-checked with nephelometer and/or transmissometer measurements. Knowledge of the main constituents of a site's light extinction ``budget'' is critical for source apportionment and control strategy development. These methodologies allow estimates of how proposed changes in atmospheric constituents would affect future visibility conditions.

Currently, the IMPROVE monitoring protocols for aerosol, optical, and scene measurements are not included as Federal reference methods because visibility is not regulated under the NAAQS. The EPA is developing a visibility monitoring guidance document, however, that will identify important methods and procedures for effective aerosol, optical, and scene monitoring.

Question: Will the current IMPROVE network be sufficient to determine reasonable progress for mandatory Federal Class I areas?

States implementing a new regional haze program can benefit from the existing infrastructure of the IMPROVE network, established protocols, existing sites, and historical data available. The fact that monitoring equipment is located at only about a quarter of the 156 mandatory Federal Class I areas, however, raises the issue of whether the current configuration is representative of all sites, and whether the network needs expansion. The GCVTC, in its recommendations on future technical needs, states that: "The current IMPROVE monitoring network only measures aerosol samples twice a week and at only a few Federal Class I sites * * *. **Consideration should be given to expanding the coverage or redeployment of resources in the IMPROVE network to enhance completeness of the data set, including on tribal lands. In addition, background surveillance sites could be established at intermediate locations between Federal Class I areas and large regional sources (metropolitan areas) to provide a better understanding of the intermediate course of atmospheric chemistry and transport. Monitoring should be maintained at existing sites in order to allow for long-term trend analysis."**

Part VI - Proposed Requirements

Visibility SIP submittals and State reasonable progress demonstrations likely will rely on monitored data from the IMPROVE network. Thus, it should be determined whether the existing geographic distribution of IMPROVE network sites is adequate for making future determinations of reasonable progress in all Federal Class I areas and for verifying models for predicting possible visibility effects of future air quality management strategies. In addition, the ability for the current cooperative arrangement between EPA, FLM's and the States for managing and funding the network in the future should be assessed.

It is recognized by EPA as well as many outside groups including the Clean Air Act Advisory Committee's Subcommittee on Ozone, Particulate Matter, Regional Haze Implementation Programs and the National Research Council in its 1993 report "Protecting Visibility in National Parks and Wilderness Areas" that **chemical speciation of PM data would permit development of more effective control strategies to better target those sources of emissions that are causing or contributing to elevated levels of $PM_{2.5}$ and PM_{10}.** Speciation of $PM_{2.5}$ data can also be used to develop reliable estimates of seasonal and annual average visibility conditions.

Because of the costs associated with conducting filter analysis on a routine basis, this proposal only requires filters to be archived so they are available for analysis on an as needed basis. The EPA requests comment, however, on the extent to which chemical

speciation should be conducted. This would include: (1) Whether specific monitoring sites should be designated for such analyses; (2) the criteria to be used to select sites for speculated sampling and analysis; (3) the extent and frequency to which speciation should be required by EPA for at least some monitoring stations and (4) the need for monitoring methodologies not described in this proposal which may be needed to facilitate compositional analysis. The EPA recognizes that there is a need for speciation and other specialized monitoring efforts which are not specifically required by this proposed rule. Accordingly, EPA will give these PM monitoring efforts high priority in its section 105 grants program. **The Administrator solicits comment on the appropriate portion of the nation's monitoring resources which should be dedicated to speciation and collection of special study data relative to the siting and collection of mass measurements for purposes of comparisons to the NAAQS and visibility assessments at permanent and temporary monitoring stations.**

Finally, in anticipation of a new regional haze program and associated additional monitoring requirements, EPA also requests comment on ways that the future PM and IMPROVE networks can be coordinated to conserve resources and serve the goals of both the PM and regional haze implementation program.

Appendix C would be amended. Proposed new section 2.9 would define so-called "IMPROVE" samplers for fine particulate matter and clarify that IMPROVE samplers, although not designated as equivalent methods, could be used in SLAMS for monitoring regional background concentrations of fine particulate matter.

2.9 Use of IMPROVE Samplers at a SLAMS. **"IMPROVE" samplers may be used in SLAMS for monitoring of regional background concentrations of fine particulate matter.** The IMPROVE samplers were developed for use in the Interagency Monitoring of Protected Visual Environments (IMPROVE) network to characterize all of the major components and many trace constituents of the particulate matter that impair visibility in Federal Class I Areas. These samplers are routinely operated at about 70 locations in the United States. IMPROVE samplers consist of four sampling modules that are used to collect twice weekly 24-hour duration simultaneous samples. Modules A, B, and C collect $PM_{2.5}$ on three different filter substrates that are compatible with a variety of analytical techniques, and module D collects a PM_{10} sample. $PM_{2.5}$ mass and elemental concentrations are determined by analysis of the 25mm diameter stretched Teflon filters from module A. More complete descriptions of the IMPROVE samplers and the data they collect are available elsewhere (References 5.2, 5.3, and 5.4 of this Appendix).

Crocker Nuclear Laboratory Internal Report
Robert Eldred
PM Standards in the IMPROVE Network
January 28, 1997 (revised 3/6/97)

Summary: This report examines the annual and 24h values for $PM_{2.5}$ and PM_{10} for the sites using IMPROVE samplers. This follows the EPA proposed calculations except for the discarding of a year if any quarter has less than 75% of the possible periods. All calculations are for the 3-year period of calendar years 1993, 1994, and 1995.

1. There is only one violation: Washington DC has an annual $PM_{2.5}$ value of 18.6 $\mu g/m^3$, which is 24% over the standard.

2. All eastern remote sites, except in New England and Minnesota, have annual $PM_{2.5}$ values between 10.4 and 13.9 $\mu g/m^3$, which are 70% to 90% of the standard. If we assume that the urban areas have slightly more $PM_{2.5}$ than remote sites, we may find that most urban eastern sites will exceed the standard.

3. The eastern sites are generally further from the 24h $PM_{2.5}$ standard than the annual $PM_{2.5}$ standard. The range, including Washington DC, is 28 to 41 $\mu g/m^3$, which is 56% to 81% of the standard.

4. These eastern sites are well below the annual or 24h PM_{10} standards. Washington DC is 25.8 $\mu g/m^3$, which is 52 % of the standard. No other site is above 22 $\mu g/m^3$.

5. One western site, Sequoia, has annual and 24h $PM_{2.5}$ values of 11.9 and 36 $\mu g/m^3$, which are around 75% of the standards. The two New England sites and three special western sites (urban So Lake Tahoe, and San Gorgonio and Point Reyes with influences from Los Angeles and San Francisco) have annual and 24h $PM_{2.5}$ values of around 50% of the standards. Most western sites are around 25% of these standards.

6. The western sites are generally farther from the PM_{10} standards than from the $PM_{2.5}$ standards. No western IMPROVE site is 39% of the standard.

Tables 1 and 2 list the annual and 24h values for $PM_{2.5}$ and PM_{10} for the sites using IMPROVE samplers. This follows the EPA proposed calculations except for the discarding of a year if any quarter has less than 75% of the possible periods.

Figures 1 and 2 plot the ratios of value/standard. This is a nice way to present the data.

Figure 3 shows the location of the sites. Figure 4 presents a map of annual averages for $PM_{2.5}$.

3/6/97 Revision: The annual mean $PM_{2.5}$ mass concentration at Bryce Canyon National Park was changed from 2.5 to 3.1 $\mu g/m^3$. The original had a transcription error. Revision are made to Table 2 and Figure 4.

Table 1. Annual and 24h PM values from the IMPROVE Network 3-year (1993-95), for sites with $PM_{2.5}$ annual exceeding 5 $\mu g/m^3$. These follow the EPA guidelines except for discarding year if any quarter is below 75% recovery. The sites are ordered by $PM_{2.5}$ annual concentrations. The right side lists the ratio of value divided by the standard.

	$PM_{2.5}$		PM_{10}		$PM_{2.5}$		PM_{10}	
	annual	24h	annual	24h	annual	24h	annual	24h
STANDARD	15	50	50	150	fraction of standard			
Washington	18.6	41	25.8	53	1.24	0.81	0.52	0.36
Sipsey	13.9	30	19.8	44	0.93	0.60	0.40	0.29
Mammoth Cave	13.4	34	19.0	44	0.89	0.67	0.38	0.29
Dolly Sods	12.7	40	17.3	53	0.85	0.80	0.35	0.35
Great Smoky Mtns	12.6	39	18.0	50	0.84	0.77	0.36	0.33
Shenandoah	12.0	38	17.0	48	0.80	0.76	0.34	0.32
Sequoia	11.9	36			0.79	0.72		
Brigantine	11.5	30	21.9	46	0.77	0.59	0.44	0.31
Okefenokee	10.7	29	18.1	40	0.71	0.58	0.36	0.27
Upper Buffalo	10.6	28	17.6	43	0.71	0.56	0.35	0.29
So Lake Tahoe	8.7	23	19.4	56	0.58	0.47	0.39	0.37
San Gorgonio	7.6	19	15.5	42	0.51	0.37	0.31	0.28
Lye Brook	7.4	27	11.3	32	0.49	0.55	0.23	0.21
Point Reyes	7.1	22	16.9	41	0.47	0.43	0.34	0.28
Acadia	6.9	25	11.8	36	0.46	0.50	0.24	0.24
Big Bend	5.8	14	13.2	34	0.39	0.27	0.26	0.23
Glacier	5.8	18	11.2	36	0.39	0.35	0.22	0.24
Pinnacles	5.6	12	13.3	28	0.37	0.23	0.27	0.19
Mt Rainier	5.2	13	6.9	19	0.35	0.26	0.14	0.13
Boundary Waters	5.1	17	8.1	22	0.34	0.35	0.16	0.15
Guadalupe Mtns	5.1	13	12.9	42	0.34	0.25	0.26	0.28

Table 2. Annual and 24h PM values from the IMPROVE Network 3-year (1993-95), for sites with $PM_{2.5}$ annual below 5 $\mu g/m^3$. These follow the EPA guidelines except for discarding year if any quarter is below 75% recovery. The sites are ordered by $PM_{2.5}$ annual concentrations. The right side lists the ratio of value divided by the standard.

	PM2.5		PM10		PM2.5		PM10	
	annual	24h	annual	24h	annual	24h	annual	24h
STANDARD	15	50	50	150	fraction of standard			
Tonto	4.9	11	11.0	26	0.33	0.21	0.22	0.17
Yosemite	4.6	14	9.0	24	0.31	0.28	0.18	0.16
Badlands	4.5	12	9.1	22	0.30	0.24	0.18	0.15
Scoville	4.5	17			0.30	0.34		
Redwood	4.4	13	10.1	25	0.29	0.26	0.20	0.16
Chiricahua	4.2	10	9.5	26	0.28	0.21	0.19	0.17
Indian Gardens	4.2	9	9.8	23	0.28	0.18	0.20	0.15
Petrified Forest	3.8	8	7.1	18	0.25	0.16	0.14	0.12
Bandelier	3.6	9	7.6	18	0.24	0.18	0.15	0.12
Craters of Moon	3.6	12			0.24	0.25		
Bliss	3.3	9	5.9	14	0.22	0.18	0.12	0.09
Grand Canyon	3.3	8	7.4	19	0.22	0.16	0.15	0.13
Canyonlands	3.2	7	8.6	24	0.21	0.14	0.17	0.16
Great Sand Dunes	3.2	8	8.4	21	0.21	0.15	0.17	0.14
Rocky Mountain	3.2	8	7.7	19	0.21	0.17	0.15	0.12
Lassen Volcanic	3.1	9	5.5	16	0.21	0.18	0.11	0.11
Mesa Verde	3.1	7	6.9	19	0.21	0.14	0.14	0.13
Bryce Canyon	3.1	7	6.4	16	0.21	0.13	0.13	0.10
Yellowstone	3.1	10	7.5	15	0.21	0.19	0.15	0.10
Great Basin	3.0	7	6.8	16	0.20	0.14	0.14	0.11
Jarbidge	3.0	9	7.7	19	0.20	0.18	0.15	0.12
Haleakala	3.0	7			0.20	0.14		
Crater Lake	2.8	9	5.5	17	0.19	0.18	0.11	0.11
Weminuche	2.8	7	6.7	15	0.19	0.14	0.13	0.10
Bridger	2.5	7	5.0	13	0.17	0.13	0.10	0.08
Denali	1.9	8	4.3	14	0.13	0.16	0.09	0.09

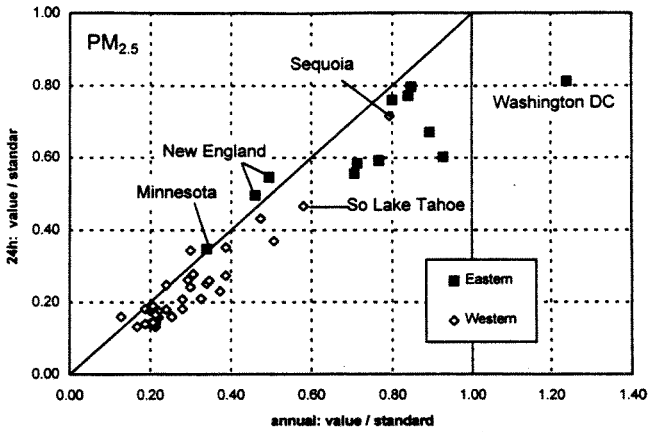

Figure 1: Ratio of $PM_{2.5}$ 3-year value / standard for annual and 24h standards for sites with IMPROVE samplers, for 1993-1995. (Data was allowed even if the recovery rate was below 75% for a quarter.) Washington DC exceeds the annual standard but not the 24h standard. The sites in New England and Minnesota are well below both standards. The remaining eastern sites are closer to the annual standard than to the 24h standard. All western sites, except Sequoia, are well below both standards. (These include sites in Alaska and Hawaii.) The one urban western site with an IMPROVE sampler, South Lake Tahoe, is also well under the standards.

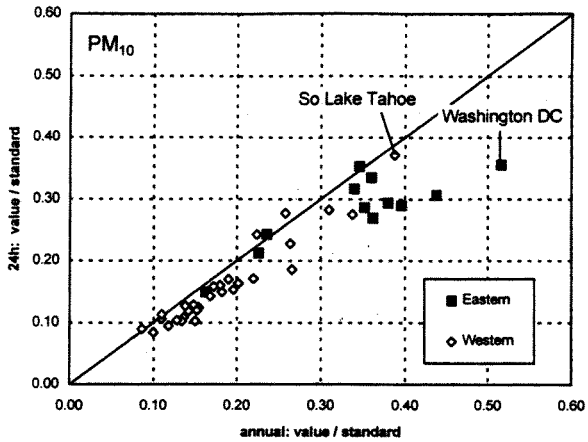

Figure 2: Ratio of PM_{10} 3-year value / standard for annual and 24h standards for sites with IMPROVE samplers, for 1993-1995. The standard is not exceeded at any site. (The 98th percentile 24h concentration for 1995 only at Sequoia is 170 $\mu g/m^3$, but this was associated with unusual construction and controlled burns. The 24h value for 1994 was 102 $\mu g/m^3$.) The maximum ratio is at Washington DC (annual) at slightly over 0.50.

Figure 3: Sites in IMPROVE network with three years of data from 1993 to 1995.

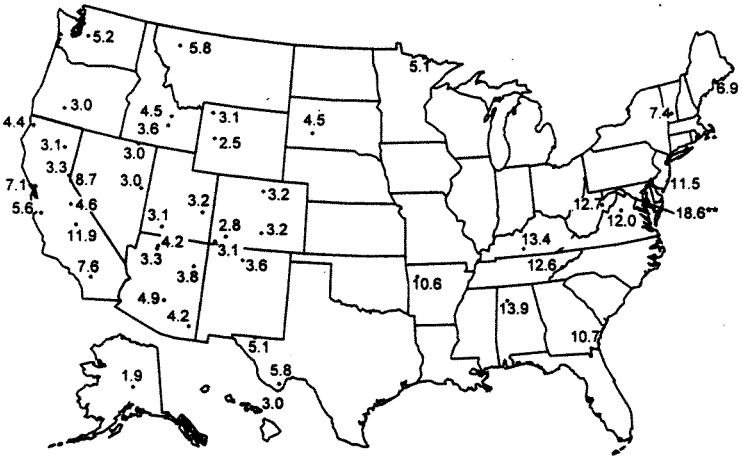

Figure 4: Annual $PM_{2.5}$ mass concentrations for IMPROVE network sites, 1993 to 1995.

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

March 31, 1997

Honorable Thomas J. Bliley Jr.
Chairman
Committee on Commerce
U.S. House of Representatives
2123 Rayburn House Office Building
Washington, D.C. 20515-6115

Dear Tom:

This is in response to your March 20, 1997, letter. The Department of Agriculture (USDA) has submitted documents to the Environmental Protection Agency's (EPA) public docket for the proposed National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter. These documents are enclosed for your review and described below.

The first of these documents is entitled "Issues Concerning the PM and Ozone Rules." USDA submitted this document to the Office of Management and Budget (OMB) during the interagency review process, and it was subsequently submitted to EPA's public docket.

USDA has continued to work with EPA and the other agencies through the OMB interagency review process to share information about the proposed NAAQS to gain a better understanding of their effects on agriculture. On March 26, 1997, USDA presented technical comments on the proposed rule to the interagency working group and submitted those comments to EPA's docket, entitled "United States Department of Agriculture Technical Comments on the Environmental Protection Agency's Proposed National Ambient Air Quality Standards: Ozone and Particulate Matter."

Finally, USDA submitted to EPA's docket correspondence from the Department's Agricultural Air Quality Task Force on the NAAQS proposals.

USDA will continue to submit technical documents to EPA's docket, as appropriate. In addition, it is USDA's understanding that EPA will submit to the docket summaries of discussions that occur throughout the interagency process.

If you have any additional questions, please do not hesitate to call.

Sincerely,

DAN GLICKMAN
Secretary

Enclosure

ISSUES CONCERNING THE PM AND OZONE RULES

- The proposed regulations, Staff Paper, and Regulatory Impact Analysis (RIA), were confusing to read because did not always analyze the same regulatory scenarios. The details of costs and benefits resulting from a proposed standard may be sensitive to small changes in the standards. Can the RIAs provide detailed assessments of the proposed and alternative primary and secondary standards?

- While the regulatory package is quite extensive, it does not contain detailed information regarding specific effects on agriculture that may be caused by pollution or that may result from pollution controls. For example, the RIAs for ozone and PM list pollution control measures that could be imposed, but do not provide information on the allocation of costs to different industries or regions. Farm groups have expressed their concern that the proposed standards may impose significant costs on farmers and agribusiness. We can neither verify nor dismiss these concerns even with information contained in the Staff Papers. We have requested copies of background information, such as contractor reports from EPA, and EPA has cooperated with the agency in this regard. May we have access to detailed information upon which the regulatory packages are based so that it can address the concerns of constituents?

- A major issue is that of residual nonattainment. In both RIAs costs and benefits were estimated using a year 2007 baseline. However, in some cases, areas implementing all available control technology are not able to attain the proposed standards. Benefits are based on full attainment of the proposed standards. Costs however, do not reflect the full costs of attainment because some areas do not attain either the ozone or PM standards in 2007 using current control technologies. This issue is particularly difficult because of the uncertainty associated with predicting the costs and effectiveness of new technologies 10 years hence. This is weighed against apprehension in the regulated community faced with uncertain future costs of compliance. Can EPA address this issue in the final RIAs?

- The proposals are presented as separate almost unrelated documents. While there is some qualitative discussion of the linkages between ozone and PM pollution in both regulatory packages, there is no explicit analysis of the joint costs and benefits of ozone and PM control. Since EPA has published the proposals together and is treating them as a total package, can EPA provide an analysis of the joint impacts of these standards?

- We share the concerns of the Small Business Administration regarding the potential impacts of these proposals on small businesses. Can EPA address these concerns before the final rule is issued?

- Finally, we believe the PM-2.5 regulation will take a considerable period of time to implement because a completely new monitoring system must be designed and built. With farmers and other small businesses concerned about the potential impact of these proposed standards, can EPA provide more details on implementation logistics for PM-2.5 to us?

United States Department of Agriculture
Technical Comments on
The Environmental Protection Agency's Proposed
National Ambient Air Quality Standards:
Ozone and Particulate Matter

Comments on Ozone Effects on Agriculture

Research shows that plants could be more susceptible to the adverse effects of ozone than animals. USDA scientists have extensively studied the effects of ozone on common cultivars used in food production and on seedlings of some tree species. EPA's analysis of the effects of ozone on plants, presented in the *Staff Paper* and discussed in the proposals and supporting documents, is a thorough review of the current scientific knowledge on these issues. However, research on these effects must continue if the data necessary to better determine the full benefits and potential disbenefits of reducing ozone pollution on agricultural and ornamental cultivars and trees is to be developed. These data are critical if more complete estimates of the economic and social welfare benefits of reducing ozone pollution are to be obtained. EPA and USDA should expand our joint research program with the aim of assessing the welfare effects of alternative ozone standards.

USDA scientists commend EPA for their analysis of the adverse effects of ozone on plants. This data is the primary reason for positive estimates of monetary welfare benefits of the 0.08 ppm alternatives presented in the Regulatory Impact Analysis (RIA). USDA scientists believe there could be additional benefits to plants from a more biologically relevant secondary standard such as the proposed SUM06 secondary standard. This view is based on analysis of data concerning the cumulative effects of ozone on plants over the growing season. However, EPA is unable to monetize a number of significant benefit categories including the benefits to many fruit and vegetable crops, ornamental horticultural crops, the benefits to growing and mature trees, and the effects of ozone on ecosystems. The lack of data characterizing benefits associated with increased plant productivity resulting from reductions in ambient ozone concentrations suggests a need for additional research by USDA and EPA scientists. USDA is currently allocating more than $4.0 million in fiscal year 1997 funds toward ozone-related research. We urge EPA to work with us to develop a long-term research agenda for addressing these critical issues.

USDA has reviewed EPA's RIA and the analysis of the secondary ozone NAAQS. The inability to estimate the incremental costs and benefits associated with attaining the alternative NAAQS concerns us. We are particularly concerned with the costs that could be incurred by residual nonattainment areas in their efforts to attain the standards. USDA appreciates the difficulties EPA faces in projecting air quality and the costs and benefits of emissions controls in the year 2007. However, EPA's inability to estimate the full attainment costs of the 0.08 ppm primary standard raises questions about the incremental benefits of a SUM06 secondary standard. Many small farms could be affected either directly or indirectly if the SUM06 alternative secondary standards were adopted and rural areas that attain the proposed primary standard may not be in attainment of the secondary standard. No analysis of these potential economic impacts is presented in the RIA. Some of these impacts could affect the costs of inputs such as diesel fuel,

gasoline, and fertilizer and could affect the financial performance of small farms and the economic value of farm businesses. These incremental benefits and disbenefits, and the potential economic impact on these small entities associated with a SUM06 standard, as opposed to a 0.08 ppm standard, have not been adequately estimated. USDA is committed to pursuing an aggressive research agenda that will establish sufficient data to monetize costs and benefits of further ambient ozone reductions.

Comments on PM-2.5 Monitoring

Controlling PM-2.5 emissions will likely cost more than controlling PM-10 emissions, and therefore it is important that EPA develop a scientifically rigorous method for monitoring PM-2.5 in ambient air and an equally rigorous method for determining source apportionment of monitored material. Accurate monitoring is especially important to agriculture because PM emissions from agriculture can be closely related to weather conditions. USDA scientists are concerned about the performance of PM monitors in windy conditions. Because of our extensive experience with PM monitoring in Federal Class I areas through the Interagency Monitoring of Protected Visual Environments (IMPROVE) program, USDA is using PM-2.5 monitoring data to develop and refine methods for speciating particles. The continued development of these methods used in the IMPROVE program and their extension to other areas where PM monitoring will be necessary, as the monitoring network is developed, could contribute to increased effectiveness and reliability of the proposed system. USDA scientists have provided specific suggestions that may help EPA and States develop a reliable and practical monitoring system for PM-2.5.

The Federal Reference Method

The proposed Federal Reference Method (FRM) adequately addresses concerns about distinguishing between coarse and fine particles. We suggest that EPA consider a variation on the auditing requirements and the 3-year moratorium on monitoring regulations to allow existing PM-2.5 monitors to be used and evaluated for potential use in the state's monitoring plans.

Incentives for Monitoring

We support EPA's efforts to allow the use of other monitors for the next 3 years without fear of regulation, however, the complexity of the proposal makes it unclear how a company benefits by helping with the monitoring program. We suggest a clearer explanation of which data would not be admissible for the designation of nonattainment areas, for siting state and local air monitoring system (SLAMS), national air monitoring system (NAMS), and photochemical air monitoring system (PAMS) monitors, and for assessing the need for speciation. USDA welcomes the opportunity to work with EPA in developing monitoring regulations.

Special Purpose Monitoring

We agree with EPA on the importance of special purpose monitoring. The Forest Service

has been involved in many such projects and suggests one other criterion for such monitoring. Special purpose monitoring should emphasize longer term monitoring in or near areas to be protected or for data needed for model validation. We believe it would often be a better use of scarce dollars to monitor in locations that are indicative of exposure and will aid us in assessing the effectiveness of control strategies such as smoke management.

Auditing

The auditing provisions have the potential for identifying and testing, in the field, new technologies that not only give the correct mass reading, but may also be developed to provide better speciation information. We recommend EPA also consider the possibility of using these provisions with existing PM-2.5 technology so that the years of data already collected are not lost and may be converted into FRM monitoring as funds permit.

Speciation

Based on our experience with the IMPROVE network, we have found that speciation is critical for understanding the sources contributing to an area's air pollution problem. The FRM proposed in Part 50 is adequate to determine the mass of PM-2.5 on which the standards are based. That would suffice for the process of designating the areas that are not meeting the NAAQS. It will not, however, give sufficient information on which to base sound control strategies. Specifically, we have found, using the IMPROVE samplers, that several types of filter media are needed in order to perform the kinds of chemical analyses required to speciate a sample. In addition, while EPA has allowed the archiving of filters for later analysis, there is not adequate consideration for the loss of volatile chemicals, the chemical reactions on the filters over time, or the interference of the filter medium with the chemical tests. We suggest that EPA consider the feasibility of a FRM that uses different filter media for different days.

Section 6.10 of Part 50 should reference information on the speciation from the IMPROVE network. We recommend that EPA be as specific as possible about the acceptable ways of performing speciation and what knowledge that information will provide a regulatory decision maker. Acceptable methods for speciation should be stronger than guidance, but not as prescriptive as a FRM.

We are concerned that archiving the filters will allow volatile compounds to be lost. Furthermore, even with IMPROVE, the analysis of nitrates, and other volatile hydrocarbons is problematical and needs to be improved. We suggest that EPA consider specifying standards for collecting optional speciated data so that information used in making important control strategy decisions is reliable. Local areas should determine which tests they will devote resources to, but for example, when they analyze for nitrates it should be comparable to other nitrate analyses done nationally. Further, the kinds of species that should be tested for should represent the major contributors to the PM-2.5, ozone, and regional haze problems. We suggest that EPA reserve the

right to modify the speciation specifications as needed and as new techniques become available. We also suggest that EPA consider the preliminary research data pointing to the role of specific chemical constituents on fine particles, like metals and very reactive hydrocarbons, and consider defining a protocol that could be used now to collect data. This data could be used to form the basis for the development of more specific PM standards that can be based on causal agents.

Precursors and Integration with Ozone

The *Criteria Documents* for both PM and Ozone recognize that the precursors for these pollutants and regional haze are similar. The understanding of these precursors are critical in understanding the modeling and effectiveness of control strategies. We recommend that EPA consider a general assessment of precursors, not just PM-2.5.

Change in the Monitoring Plan Design Objectives

We support the concept of "core" SLAMS that measure regional background and transport. The discussion of the objectives for the monitoring outside populated areas is weak. It's purposes are to generate air quality data that facilitates implementation of the proposed NAAQS and augment the existing visibility network. We believe understanding the conditions in rural areas is important. Two other reasons for this monitoring are to understand the contributions of sources to background levels (through speciation of these data) and the role these sites may play in model validation (as we have seen in the Grand Canyon where efforts were hampered by lack of data between the urban areas and the Class I areas). Similarly, in the Ozone Transport Assessment Group modeling, there are significant model discrepancies and uncertainties between urban receptors that might have been clarified with rural data.

How to Optimize the PM-2.5 and IMPROVE Networks to Conserve Resources

We have compared some IMPROVE sites in order to conserve resources within the existing IMPROVE network. The optical measurements (nephelometer, telephotometer, camera) give similar results. The PM-2.5 mass is comparable, but the speciation shows that local sources do contribute locally resulting in different speciation readings. We believe the IMPROVE network characterizes the regional scale well. There are data gaps in the Midwest that would round out that network and verify our estimates of the visibility there. EPA should follow up with National Oceanographic and Atmospheric Administration to make their automated visibility measurements operational, in a mode that will be useable, for assessing visibility in urban areas using their existing sites. Further, we urge the States to look at modeling needs and recognize the need for information between the urban areas and some Class I areas. We suggest that EPA consider a phased approach, where IMPROVE sites may initially fulfill the background and transport site role for some areas until an analysis can be made to identify rural sites that may better provide model and exposure information. At that time, the monitoring plan could change to add such sites to the "core" SLAMS. One of the key values of the IMPROVE network may be

in helping States to identify when and what kind of speciation needs to be done. By examining the existing IMPROVE information, a State could verify that one season might be more important or that only two species are crucial and then prioritize the sample analyses to identify controls that may be needed.

USDA Concerns Regarding Implementation of the New NAAQS

Our concerns are primarily focused on the costs and benefits that may accrue to agriculture and rural communities and the distribution of these costs and benefits if new standards are adopted and new emissions control programs are implemented so that large areas of the United States are able to attain these new standards. USDA will work with EPA and others who administer air-quality-improvement programs to ensure the availability of the best data pertaining to emissions from agricultural activities and the effects of control programs on agriculture and rural communities.

USDA is concerned about potential effects that implementing control programs, designed to help areas attain the new standards, could have on small farms. EPA defines small entities in the RIA as establishments with less than 100 employees. In many areas of the country, agriculture is characterized by owner-operator firms that typically employ few, if any, hired workers. USDA's most recent data show that 71 percent of U.S. farms have annual sales of less that $40,000 while fewer than 6 percent have annual sales greater than $250,000. In 1994 and 1995, farmers spent about $170 billion on farm inputs and services (table 1). Both direct and indirect energy inputs account for about 22 percent of total expenditures for agricultural production. However, direct and indirect energy account for a considerable higher percentage of farmers variable expenses. As table 2 shows, energy as a percentage of variable expenses, for many major crops and for livestock operations are 40-45 percent. Farmers are sensitive to changes in variable expenses because production decisions are based on the prices of variable inputs. Production and/or use of many of these inputs could be affected by emissions control programs including fuel that powers farm equipment, electricity, fertilizers, pesticides, and other agricultural chemicals. Because a large proportion of farms are small entities, increased costs for farm inputs resulting from emission-control programs could have impact on their financial performance.

Distribution of Costs and Benefits

The data in table 2 show the variable production expenditures for major crop and livestock operations for U.S. agriculture. Regulations on emissions generated by fertilizer or chemical production will benefit the areas where this production occurs, but the costs that are passed on to farmers will be borne by those living in areas that do not benefit from these emissions reductions. Changes in fuel formulations could affect the fuel costs of all farmers regardless of where they are located. Farmers in some States with high levels of ozone or PM-2.5 pollution may benefit from emissions controls that result in decreases in ambient ozone and PM-2.5 levels. Farmers in areas with clean air will incur the costs of emissions control but no benefits from ozone or PM-2.5

reductions. USDA recognizes the need for national standards, and we are aware that it is often difficult to balance program costs and benefits across regions. We believe it is important for USDA and EPA to continue working together in assessing the science related to agricultural emissions factors, cost effective emissions control strategies, and implementation guidance.

EPA's proposed decision includes the definition and classification of a new pollutant, PM-2.5, which consists of particles with an aerodynamic 50-percent cut point diameter of 2.5 microns. Under the proposed standards, agriculture may face greater costs to control PM-2.5 emissions. Costs for PM-10 control are not likely to increase because the level of the current standard does not become more stringent. Some of these additional costs will result from PM-2.5 emissions controls in areas where PM-10 controls are already required. Other costs will accrue in areas that will not attain the proposed PM-2.5 standard but are in attainment of the current PM-10 standard. While PM-10 has a variety of sources, the majority of PM-2.5 emissions are the result of combustion processes including the burning of fossil fuels in internal combustion engines and burning of fields and forest areas. PM-10 and PM-2.5 emissions can be transported great distances and can remain suspended in the atmosphere for long periods of time. Major issues of concern to farmers and farm groups are controls of soil erosion, potential increases in fuel and energy costs resulting from regulations on agricultural equipment and inputs, and agricultural and forestry burning.

Soil Erosion

Most agricultural activities take place in rural areas. PM-10 emissions from cultivation, harvesting, or transport over unpaved roads are known to contribute to exceedences of PM-10 regulations in some areas. Severe wind erosion could also contribute to PM-10 violations in some areas. However, by maintaining the current PM-10 standards in the new NAAQS proposal, it is unlikely that additional areas will fail to attain PM-10 standards because of agricultural activities. In areas where all or some of these agriculture-related factors contribute substantially to PM-10 emissions and exceedences it is important to determine the source and consider appropriate cost effective controls. USDA research and farmers willingness to adopt new innovative technologies that improve the economic and environmental performance of farmland has led to the adoption of several technologies that are already reducing PM-10 emissions from agriculture. For example, low-till and no-till technologies reduce wind and water erosion, and reduce emissions of PM that are caused by tillage and machine operation. USDA will continue to work with EPA on issues affecting PM-10 emissions sources and control.

Some portion of PM-10 emissions generated by agriculture activities could be PM-2.5 emissions. While data on PM-2.5 emissions exist, it is not comprehensive and does not fully account for regional differences in PM-2.5 emissions sources. There are questions about the health effects of PM-2.5 resulting from dust or wind erosion compared with PM-2.5 resulting from combustion of fossil fuel. These issues make it important to establish reliable methods to speciate these particles, determine their sources, and implement proper cost effective controls.

Fuel and Energy Use in Agriculture

American farmers have become more energy efficient as new technologies and farming methods are developed. Since 1975, the amount of agricultural output produced by a unit of energy input has increased by more than 50 percent. Expenditures for direct energy used on farms (fuel and electricity) account for only about 5 percent of total farm expenditures. Farmers use less fuel than they did 20 years ago because they use farming methods like no-till to reduce machinery use and because farm equipment is more fuel efficient. Yet, as the data in tables 1 and 2 illustrate, energy related expenditures are still more than 20 percent of total production expenditures, and for many economically important crops and livestock operations energy accounts for more than 40 percent of variable expenses. For U.S. agriculture, every dollar spent on direct energy costs in agriculture is matched by more than $3.50 spent on indirect energy supplied by agricultural chemicals and fertilizers. Emissions from many facilities that manufacture agricultural inputs are already regulated. There are no current regulations restricting the use or application of agricultural chemicals that are related to controlling ozone or PM-forming emissions. Many of these potential agriculture-related emissions sources are seasonal and specific to local or regional agricultural activities and soil types. USDA suggests that before EPA approves regulation of agricultural activities in a State Implementation Plan, they require a detailed area and source specific analysis of agricultural emissions.

Emissions from agricultural equipment are decreasing as a result of EPA regulations of off-road engines. In these regulations, EPA has developed manufacturer's emissions standards for off-road engines in the 150-750 brake-horsepower class, and engine manufacturers are already complying with the regulations. EPA is also regulating emissions from engines used in small power equipment like mowers, power saws, and chippers. These regulations are independent of EPA's proposed standards for PM and ozone, but their effect will be a significant reduction in PM, hydrocarbon, and nitrogen oxides (NOx) from agriculture equipment. USDA believes that these regulations in conjunction with new farming methods and technologies are cost effective emissions control strategies that also maintain agricultural productivity and competitiveness. USDA urges EPA to consider cost effectiveness and competitiveness when developing further regulations or regulatory guidance regarding farm equipment emissions.

Agricultural and Forest Burning

Burning is often a necessary practice in agriculture and forestry operations. Fire can be used to effectively manage noxious weeds and plant diseases and can be an effective tool in managing future fire hazards. EPA and the USDA Forest Service have been engaged in discussions about the use of fire as a forest management tool. We believe these discussions have established an appropriate framework for using prescribed fire in forest management. Recently these discussions have been expanded to include the use of fire as a management tool on private forest, agricultural, or range lands. USDA urges EPA to develop a sufficiently flexible policy with agriculture and forestry groups and private landowners for using fire as a land management tool while reducing the probability that such burning will lead to excessive levels of PM emissions.

Implementation and Research

Many of the issues that are likely to affect agriculture are associated with implementing emissions control programs in specific nonattainment areas. Currently, there are many questions about agriculture's contributions to pollution inventories from direct emissions or from emissions that may form pollution through secondary reactions. In addition, more research is needed on the effects of air pollution on food and fiber production. USDA is committed to a peer reviewed research program that addresses emissions generation, air pollution control, and the effects of reduced levels of pollution on agricultural and forest productivity.

USDA representatives serve on committees EPA has formed under the Federal Advisory Committee Act (FACA) dealing with implementation issues. The broad scope of these proposed standards and the likelihood that agriculture will be affected by programs implemented to attain them increases the necessity for USDA and EPA to develop a joint research program that is aimed at answering critical research questions. Moreover, section 391 of the Federal Agriculture Improvement and Reform Act of 1996 requires USDA, through the Chief of the Natural Resources Conservation Service, to establish the Agricultural Air Quality Task Force. The Task Force has been formed in accordance with FACA requirements for the purpose of: 1) reviewing research on agricultural air quality issues; 2) making recommendations to the Secretary of Agriculture on air quality policies that are based on sound science and economic feasibility; 3) working to ensure intergovernmental cooperation when air quality policies that affect agriculture are established; and 4) assisting other Federal agencies in the development of data related to agricultural air quality. We believe the FACA can act as a forum for developing a deeper understanding between EPA and the agriculture community on many of the issues being discussed in these comments. We look forward to EPA's participation and cooperation on this important work.

The FACA process under which the Task Force will operate is only one of many efforts USDA has in place for evaluating the effects of PM and ozone pollution on agriculture. Currently USDA has nearly $8.0 million in direct support for PM and ozone research at various centers around the U.S. USDA research on air quality issues is broad, ranging from the effects of ozone on plant growth and development, developing methods for monitoring and speciating PM emissions, studying the transport characteristics of pollutants and their precursors, and studying the complex interactions among pollutants that cause visible haze. Through our laboratories and in cooperation with Land Grant institutions, USDA agencies will continue an aggressive research agenda on agricultural air quality issues. Continued regular discussions on research needs and priorities between USDA and EPA will help promote an awareness of potential concerns and allow for a more coordinated research approach.

Table 1--Farm Production Expenses

Item	Calendar year 1994	1995
	$ million	
Feed purchased	22,628	24,528
Livestock & poultry purchased	13,250	12,557
Seed purchased	5,373	5,463
Farm-origin inputs	41,251	42,548
Fertilizer and lime	9,181	10,034
Fuels and oils	5,323	5,687
Pesticides	7,219	7,719
Manufactured inputs	21,723	23,440
Short-term interest	5,954	6,690
Real estate interest	5,853	6,067
Total interest charges	11,807	12,757
Reapir and maintenance	9,185	9,427
Contract and hired labor	15,308	16,285
Machine hired and custom work	4,790	4,792
Marketing storage, and transportation	6,708	7,182
Misc. operating expenses:	17,109	19,443
Electricity 1/	2,600	2,835
Other operating expenses	55,700	59,964
Capital consumption	18,780	19,107
Taxes	6,659	6,891
Net rent to operators landlords	11,525	10,873
Other overhead expenses	36,964	36,871
Total production expenses	167,445	175,580
Energy:		
Direct	7,923	8,522
Indirect	28,563	29,996
Total	36,486	38,518
Energy as % of total production expense	21.8	21.9

Table 2: TOTAL PRODUCTION AND ENERGY EXPENDITURES BY CROP 1994-95

Crop	Total Variable Cash Expenses	Direct*	Indirect**	Energy Expenditures as % of total variable expenses
		'$ Dollars per planted acres		
Corn	147.08	18.96	47.88	45.4
Grain Sorghum	80.39	13.30	21.87	43.7
Soybean	75.76	7.93	24.00	42.2
Wheat	59.98	8.55	13.26	36.4
Barley	67.68	11.43	17.55	42.8
Oats	50.47	6.84	13.25	39.8
Rice	342.96	62.29	95.36	46.0
Cotton	276.95	31.03	66.55	35.2
Cow-calf	329.91	18.43	68.66	26.4
Hog	38.44	1.56	14.14	41.7
Farrow-to-finish	34.23	1.48	12.65	41.3
Farrow-to-feeder	62.30	4.61	19.44	38.6
Feeder pig-to-fini	45.69	0.76	18.13	41.4
Milk	11.35	0.49	3.62	36.2
Peanut	350.49	33.07	115.09	42.3
Sugar beet	419.30	40.56	100.93	33.7
Sugarcane	689.29	25.38	97.85	17.9
Tobacco	1,885.19	330.23	245.24	30.5

* fuel, lube, electricity

** indirect energy expenses are equal to 40% of seed expense, 50% of fertilizer and chemical expenses, 15% of customer operations expenses and 10% of repairs and purchased irrigation water

USDA United States Department of Agriculture

Natural Resources Conservation Service

P.O. Box 2890
Washington, D.C.
20013-2890

March 10, 1997

SUBJECT: Agricultural Air Quality Task Force

TO: Dan Glickman, Secretary

The Agricultural Air Quality Task Force, that you recently appointed in accordance with the provisions of the 1996 Farm Bill, held their first meeting on March 5-6, 1997. All but four members were present (Dr. Joseph Miller, Ms. Mary Nichols, Mr. Clinton B. Reeder, and Mr. J. Read Smith). However, Ms. Nichols was represented by Ms. Sally Shaver. I believe the meeting was extremely successful and productive, and I am confident this Task Force will prove to be a valuable asset to you and the Department. A listing of the members is attached for your reference.

Attached for your use and information is a letter from the Task Force concerning their major recommendations resulting from this meeting. The recommendations do not necessarily reflect total unanimity in all cases, but do reflect a very strong prevalence of opinion that they want you to be aware of as you develop the Department of Agriculture's response to EPA's proposed changes in air quality standards.

At your convenience, we will arrange for a more detailed briefing on the session. Our next meeting is scheduled for June 17-19, 1997 in California.

PAUL W. JOHNSON
Chief

Attachments

cc:
James R. Lyons, Under Secretary for Natural Resources & Environment

USDA United States Department of Agriculture

Natural Resources Conservation Service

P.O. Box 2890
Washington, D.C.
20013-2890

March 10, 1997

SUBJECT: Agricultural Air Quality Task Force

TO: Dan Glickman, Secretary

We, a subcommittee representing the Agricultural Air Quality Task Force, have been asked by the full task force to share with you the prevailing concerns and recommendations arising from the first Task Force session held March 5-6, 1997. In order for you to be aware of these concerns prior to the U.S. Department of Agriculture (USDA) submission to the U.S. Environmental Protection Agency (EPA) on their proposals for ozone and particulate material standards and as a guideline for future considerations by your office relative to agricultural related air quality issues, we respectfully submit the following:

- The EPA proposed air quality standards, in our judgment, are not based on adequate scientific evidence, peer review, and interpretation. Thus, we recommend that it is premature for EPA to change the existing standard until scientific evidence is correctly obtained and interpreted. We especially challenge the scientific basis of EPA estimates of agricultural impacts.

- Given the current state of inaccuracies and misconceptions within the EPA air quality standards and applications, and in the spirit of cooperation, we believe it is imperative that USDA develop a specific Memorandum Of Understanding (MOU) with EPA to transfer technical expertise and support for those air quality issues derived by the Clean Air Scientific Advisory Committee which significantly involve or impact the agricultural industry. Agricultural scientists possess the knowledge to provide this expertise which will maintain the USDA confidence and integrity among the agricultural industry producers. This must be a serious and ongoing commitment by USDA to provide this avenue of knowledge, research, development, and technology transfer.

- We found that many current agricultural air quality issues beg for additional understanding and knowledge well beyond that which exists today. Examples are the unknowns about particulates emitted by wind blown dust, field operations, and nonroad engine emissions and their health implications. We would recommend you consider a Departmental air quality research initiative to provide the level of understanding of the environmental impacts this issue demands, in the same vein as that in which we addressed water quality issues in recent years cooperatively among several agencies.

- There are often multiple policies and programs, air quality being only one of several, which cause conflict and misunderstanding among producers who are asked to implement controlling practices. For example, some EPA regulations require a reduction in

agricultural burning. However, the conservation practice "Prescribed Burning" is an effective tool for some selected production systems to control pests and diseases. We would encourage you to seek coordination of these several programs.

- We believe that agricultural producers can and will provide many of the control measures required to comply with air quality standards as our society requires, but it is imperative that they be provided the knowledge and flexibility to design and voluntarily apply these controls locally as the technology would suggest for best strategies and economic feasibility. We would advise you to provide the leadership, in cooperation with EPA scientists, to our agricultural producers to arrive at these appropriate control strategies.

We appreciate your initiative to appoint us to your public advisory committee on air quality research as set forth in the 1996 Farm Bill. We again express our sincere appreciation for this opportunity to participate with you in this very important agricultural issue, and we look forward to our future deliberations.

USDA Agricultural Air Quality Task Force Subcommittee:

Emmett Barker	Keith Saxton
Thomas Ferguson	Dennis Tristao
Eric Hurley	Manuel Cunha
Phillip Wakelyn	

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

OFFICE OF CHIEF COUNSEL FOR ADVOCACY

NOV 18 1996

Honorable Carol Browner
Administrator
United States Environmental Protection
Agency
401 M Street, S.W.
Washington, D.C. 20460

Subject: SBREFA and EPA Review of the National Ambient Air Quality Standards (NAAQS) for Ozone

Dear Administrator Browner:

This letter addresses a matter of great importance to small businesses: the Environmental Protection Agency's review of the National Ambient Air Quality Standard (NAAQS) for ozone. We received a copy of the draft regulation on November 8, now scheduled to be proposed late this month.[1] In the draft regulation, EPA avoids preparing a regulatory flexibility analysis by making a certification under the Regulatory Flexibility Act, 5 U.S.C. §601 et seq., that the revision of the ozone NAAQS will not have a "significant economic impact on a substantial number of small entities." Considering the large economic impacts suggested by EPA's own analysis that will unquestionably fall on tens of thousands, if not hundreds of thousands of small businesses, this would be a startling proposition to the small business community.

We urge the agency to rethink its position, and convene a small business advocacy review panel as required by the new Small Business Regulatory Enforcement Fairness Act. EPA has included some preliminary small business analysis within its draft economic analysis, but some additional work needs to be done to conform with the requirements of the initial regulatory flexibility requirements of 5 U.S.C. §604. We also suggest that the agency reconsider the stringency of the proposal.

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[1] The Clean Air Act requires EPA to set air quality standards in the form of National Air Quality Ambient Standards (NAAQS). These standards serve as the baseline for measuring whether areas of the country are in attainment with the Clean Air Act's air quality goals. Nonattainment areas are subject to requirements that are designed to improve the air quality in order to permit the areas to attain compliance with the NAAQS.

I. SBREFA Does Apply To this Rulemaking.

In the November 1 draft preamble, EPA indicated that the revision of the ozone NAAQS would not require the preparation of a regulatory flexibility analysis because the regulation does not *directly* regulate small businesses, and therefore, has no impact on small entities, as those terms are used in the Regulatory Flexibility Act. Instead, the small businesses are only regulated as a result of additional federal and state regulatory actions in order to bring the nonattainment regions into compliance with the revised, more stringent standard. EPA relies on two court cases to support its position that SBREFA does not apply to this rulemaking. While this position is arguable, we do not believe that the holding of those cases apply to this regulation.

In the Mid-Tex and United Distribution cases[1] cited by EPA, the petitioners sought to require the Federal Energy Regulatory Commission (FERC) to prepare regulatory flexibility analyses of its rules on entities that were not at all subject to regulation under FERC's organic statute. In both cases, the court decided against the petitioners, finding that "no regulatory flexibility analysis is necessary when [an agency] determines that the rule will not have a significant economic impact on a substantial number of small entities that are subject to the requirements of the rule." Mid-Tex, 773 F.2d at 342 (emphasis added); accord, United Distribution, 88 F.3d at 1170 ("FERC had no obligation to conduct small entity impact analysis of effects on entities which it does not regulate.").

In our view, EPA's proposed revision to the ozone NAAQS presents an altogether different situation than that on which the Mid-Tex and United Distribution cases turned. Specifically, the regulatory agency in these cases -- FERC -- had no jurisdiction to regulate the small entities that petitioners wanted to have evaluated in an RFA. In contrast, the regulatory agency in the ozone rulemaking -- EPA -- does have jurisdiction to impose controls on and otherwise regulate the small entities that would be the subject of the regulatory flexibility analysis that is being sought here. Moreover, as a result of the revised ambient standard, the agency acquires additional regulatory authority over small businesses.

First, EPA has the authority to demand -- and will inevitably continue to demand under any new ozone ambient standard program -- that states regulate small entities in their state ozone control plans. Next, those state plans must be sent to EPA for approval, and once EPA approves those regulatory programs, they become part of the federal law. Second, many federal clean air provisions that affect small businesses are automatically effective upon the redesignation of an area's nonattainment status under EPA rules and guidance (e.g. inspection and maintenance programs, auto fleet requirements).

[1] Mid-Tex Electric Cooperative, Inc. v. Federal Energy Regulatory Commission (FERC), 773 F.2d 327 (D.C. Cir. 1985); United Distribution Companies v. FERC, 88 F.3d 1105 (D.C. Cir. 1996).

Therefore, in contrast to the regulatory application issues involved in Mid-Tex and United Distribution, small firms obliged to meet control requirements under federally enforceable ozone control provisions that implement the ozone NAAQS are "subject to the requirements" of the NAAQS. EPA cannot plausibly maintain that it "does not regulate" such entities under the Clean Air Act. The clear words of the RFA indicate that agencies can only avoid the requirements if there is no "significant economic impact" on "small entities [businesses]." EPA cannot make such a finding here. Thus, the regulatory flexibility analysis and the associated SBREFA advocacy panel requirements are mandated for this rulemaking.

Not only does EPA's current position -- that promulgation of an ambient standard is wholly separable from that standard's implementation -- ignore the reality that certain measures affecting small businesses flow inexorably from promulgation of a NAAQS, but also this position may not be consistent with the Agency's previous views on this issue. For instance, in 1984, when EPA proposed to retain the then-existing NAAQS for nitrogen dioxide (NO_2), the Agency observed that while a "NAAQS for NO_2 by itself has no direct impact on small entities," it does "force ... each State to design and implement control strategies for those areas not in attainment." 49 Fed. Reg. 6876 (Feb. 23, 1984) (emphasis added).[3]

In the past, one could generally not get judicial review of Agency determinations that a given regulatory action would not have a significant impact on small entities. As you know, though, the Regulatory Flexibility Act has recently been revised to change that. The Act now provides expressly for judicial review of agency certifications under §605(b).[4] It is in this context that we strongly urge EPA to reconsider its position.[5]

II. EPA Needs to Add More Small Business Economic Analysis.

In this case, we applaud EPA's partial fulfillment of the RFA analytic requirements in its draft economic analysis under Executive Order 12286. We do ask that EPA add some additional detail on the small business impacts in the analysis, including the baseline costs of the current ozone standard and the affected small business industry impacts, that address the following issues.

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[3] EPA took a similar approach when it reaffirmed the NAAQS for carbon monoxide (CO) in 1985. The Agency reiterated that although a "NAAQS for CO by itself has no direct impact on small entities," it does "require each State to design an implement control strategies for those areas not in attainment." 50 Fed. Reg. 37,499 (Sept. 13, 1985).

[4] Specifically, subtitle D of the Small Business Regulatory Enforcement Act of 1996 revises §611 of the Regulatory Flexibility Act to provide, among other things, that "[f]or any rule subject to this chapter, a small entity that is adversely affected or aggrieved by final agency action is entitled to judicial review of agency compliance with the requirements of section[] . . . 605(b)."

[5] We have not had time to review the proposed revisions to the particulates NAAQS and its relationship to SBREFA. However, we believe that these comments apply equally to EPA's failure to convene a SBREFA panel for this proposal.

Promulgation of a revised ambient standard would have a significant impact on at least tens of thousands of small businesses. EPA's own draft November 3 analysis (admittedly very approximate) reveals shockingly high impacts. For the range of alternatives addressed in the analysis, at least 27 and, as many as 78, three digit SIC code industries (establishments with 100 or less employees) would experience an annual cost in excess of 3% of sales. At least 10, and up to 54 three digit SIC code industries would face costs in excess of 10% of sales. If EPA had examined the impacts on facilities with less than fifty employees, rather than averaging these facilities with the larger small establishments, these projected cost impacts would have been dramatically more severe. Furthermore, these costs are *in addition to the costs required by the current standards. Thus, this regulation is certainly one of the most expensive regulations, if not the most expensive regulation faced by small businesses in ten or more years.*

Implementation of this new standard means the adoption of measures that would have a dramatic impact on virtually all businesses, both large and small. For example, implementation of the revised ozone NAAQS would impose the following types of control requirements on a wide variety of sources in nonattainment areas:

- Volatile organic compounds (VOC) and nitrogen oxide (NO_x) controls for emitters of greater than 100 tons per year down to 10 tons per year for small businesses in Los Angeles and 25 tons in cities such as Houston or Chicago.
- VOC reductions -- in accordance with EPA's control technique guidelines (CTG) -- needed to meet a statutory requirement to reduce VOCs by 3% per year.
- Motor vehicle inspection and maintenance.
- Low NO_x boiler specifications for commercial and industrial facilities.
- VOC reductions on a variety of commercial and consumer products.
- Low-emission fleet vehicle requirements for employers with 10 or more vehicles.
- Autobody refinishing VOC controls in CTGs.

These controls are not optional under the Clean Air Act regulations, nor under the many guidance documents issued by EPA regarding the implementation of the current ambient standards. When states did not move promptly enough in the past to implement some of the control measures just listed, the agency issued formal findings that the states had "failed to make complete ozone nonattainment state implementation plan submittals" and threatened those states with sanctions if they did not soon adopt rules in accordance with EPA guidance. See 61 Fed. Reg. 36292 (July 10, 1996). We expect EPA to continue to follow this practice in the future.

Finally, we are extremely concerned about the cost implications of this proposal. Perhaps more importantly, this concern is heightened by the large body of evidence suggesting the paucity of health benefits that would result from a revised standard. In a November 1995 letter to EPA, the Clean Air Scientific Advisory Committee (CASAC) concluded that the health benefits from the current ozone NAAQS (0.120 ppm) appears to be generally equal to the health benefits from the more stringent ozone standards then being considered by the agency (0.07 - .09 ppm). The CASAC letter states that *none of the proposed alternative standards* (which included the draft proposal now under consideration) *were "significantly more protective of public health."* Frankly, we are puzzled by this apparent difference of opinion between EPA's own group of health experts and the EPA draft preamble. We have asked EPA staff to redraft the preamble to elaborate on this apparent difference of opinion.

In addition, we are concerned with the lack of analysis of the proposed alternative using the average of the third highest 8-hour concentrations and the unknown attendant additional costs. EPA should reconsider this form of the proposal, and consider proposing the average of the fifth highest concentrations, which was analyzed by the agency.

III. Conclusion

If EPA does not choose to convene a small business advocacy review panel, it should, at a minimum, convene an informal group of small business representatives to obtain comments on the rule after the proposal is issued. In this manner, the previous lack of small business input can be remedied. We recommend that you reconsider the proposal and add additional small business detail to the Executive Order analysis. We look forward to working further with the agency regarding this and other matters. Please feel free to contact me or Kevin Bromberg of my office at 205-6964.

Sincerely yours,

Jere Glover
Chief Counsel for Advocacy

cc: Mary Nichols, EPA
Tom Kelly, EPA
Sally Katzen, OMB

March 12, 1997

Office of Air and Radiation Docket and Information Center
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

Attention: Docket No. A-95-54 (Particulate Matter)

Dear Sir/Madam:

The agricultural, grain handling, milling and food processing industries are concerned that the Environmental Protection Agency's proposed changes to air quality standards for ozone and particulate matter could place major regulatory burdens and economic uncertainties upon agricultural production, transportation and processing. These new standards could adversely impact the continued ability of this vital sector to provide an abundant, low-cost food supply, both to the United States and to the world.

The proposed new standards for particulate matter and ozone could force state and local governments to impose significant additional regulatory burdens on farms, grain handlers, mills, transporters and processing plants. The new standards would create many new non-attainment areas across the country, both for ozone and particulate matter that would impact the entire sector either directly through new emission regulations, or indirectly through increased business costs.

Direct Impacts: Additional non-attainment areas mean a greater number of farms, ranches, grain handlers, mills, food processing plants and those who transport the product would become subject to stringent new regulations implicating significant compliance costs. Suggested possible control measures for agricultural production under the particulate matter standard include even tighter emission controls on farm equipment. Moreover, the current inability to measure fine particulate matter precisely could result in some areas setting arbitrary limits for when a farmer can enter his field for tillage, harvest of crops or application of fertilizer or crop protection materials.

While agricultural production, processing plants, grain handlers and mills are generally not major emitters of fine particulate matter or precursors of ozone or fine particulate matter, many states and localities would be forced by the new standards to target some sectors for tighter regulation. In addition, new regulations could impede a company's ability to construct new facilities or to expand and modernize existing plants. Modernization usually leads to improved pollution control/prevention, with a resultant decrease in emissions.

Indirect Impacts: Indirect impacts upon the agricultural and food processing industries may be greater than direct impacts. These industries are heavily dependent upon efficient, affordable transportation from farm to market or processing plant, and from processing plant to market. The proposed new standards could result in major increases in fuel and transportation costs as well as energy and equipment prices. As a result, the economic viability of some producers, grain handlers, millers and processors could be dramatically influenced by these motor fuel and electricity price increases. Increased costs for the agricultural sector in turn would adversely impact trade and U.S. competitiveness in the world market.

Studies are being conducted at the University of California at Davis to determine production agriculture's contribution to ambient levels of particulate matter. This research needs to be completed before proposals of such magnitude are finalized. Retention of current standards would allow time for necessary study and discussion regarding the impact of the new standards.

Substantial progress has already been made in reducing emissions of particulate matter and precursors of ozone and of particulate matter. This progress will continue as agricultural conservation practices and other Clean Air Act measures enacted in 1990 reduce emissions nationwide.

Thank you for considering our comments. We look forward to working with you on this issue.

Agricultural Retailers Association
American Farm Bureau Federation
American Soybean Association
CENEX, Inc.
Deere and Company
Equipment Manufacturers Institute
Farmland Industries, Inc.
Independent Bakers Association
Institute of Shortening and Edible Oils
Miller's National Federation
National Association of Wheat Growers
National Cattlemen's Beef Association
National Cotton Council
National Cotton Ginners Association
National Cottonseed Products Association, Inc.
National Council of Farmer Cooperatives
National Farmers Union
National Food Processors Association
National Grange
National Oilseed Processors Association
Nisei Farmers League
Pioneer Hi-Bred International
The Fertilizer Institute
USA Rice Federation

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March 12, 1997

Office of Air and Radiation Docket and Information Center
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

Attention: Docket No. A-95-58 (Ozone)

Dear Sir/Madam:

The agricultural, grain handling, milling and food processing industries are concerned that the Environmental Protection Agency's proposed changes to air quality standards for ozone and particulate matter could place major regulatory burdens and economic uncertainties upon agricultural production, transportation and processing. These new standards could adversely impact the continued ability of this vital sector to provide an abundant, low-cost food supply, both to the United States and to the world.

The proposed new standards for particulate matter and ozone could force state and local governments to impose significant additional regulatory burdens on farms, grain handlers, mills, transporters and processing plants. The new standards would create many new non-attainment areas across the country, both for ozone and particulate matter that would impact the entire sector either directly through new emission regulations, or indirectly through increased business costs.

Direct Impacts: Additional non-attainment areas mean a greater number of farms, ranches, grain handlers, mills, food processing plants and those who transport the product would become subject to stringent new regulations implicating significant compliance costs. Suggested possible control measures for agricultural production under the particulate matter standard include even tighter emission controls on farm equipment. Moreover, the current inabilit[illegible] particulate matter precisely could result in some areas setting arbitrary limit[illegible] farmer can enter his field for tillage, harvest of crops or application of fertilizer or crop protection materials.

While agricultural production, processing plants, grain handlers and mills are generally not major emitters of fine particulate matter or precursors of ozone or fine particulate matter, many states and localities would be forced by the new standards to target some sectors for tighter regulation. In addition, new regulations could impede a company's ability to construct new facilities or to expand and modernize existing plants. Modernization usually leads to improved pollution control/prevention, with a resultant decrease in emissions.

Indirect Impacts: Indirect impacts upon the agricultural and food processing industries may be greater than direct impacts. These industries are heavily dependent upon efficient, affordable transportation from farm to market or processing plant, and from processing plant to market. The proposed new standards could result in major increases in fuel and transportation costs as well as energy and equipment prices. As a result, the economic viability of some producers, grain handlers, millers and processors could be dramatically influenced by these motor fuel and electricity price increases. Increased costs for the agricultural sector in turn would adversely impact trade and U.S. competitiveness in the world market.

Studies are being conducted at the University of California at Davis to determine production agriculture's contribution to ambient levels of particulate matter. This research needs to be completed before proposals of such magnitude are finalized. Retention of current standards would allow time for necessary study and discussion regarding the impact of the new standards.

Substantial progress has already been made in reducing emissions of particulate matter and precursors of ozone and of particulate matter. This progress will continue as agricultural conservation practices and other Clean Air Act measures enacted in 1990 reduce emissions nationwide.

Thank you for considering our comments. We look forward to working with you on this issue.

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The Fertilizer Institute
USA Rice Federation

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600 MARYLAND AVENUE S.W. • SUITE 800 • WASHINGTON, D.C. • 20024 • (202) 484-3600 • FAX (202) 484-3604

March 12, 1997

Office of Air and Radiation Docket and Information Center
U.S. Environmental Protection Agency
401 M Street, SW
Washington, D.C. 20460

Reference: Federal Register

Attention Docket No. A-95-58 (Ozone)
Attention Docket No. A-95-54 (Particulate Matter)

Dear Sir/Madam:

The American Farm Bureau Federation (AFBF), the nation's largest farm organization representing the interests of more than 4.7 million member families nationwide, appreciates the opportunity to offer the following comments regarding the Environmental Protection Agency's (EPA) December 13, 1996, Federal Register Notice of Proposed Rulemaking (61 FR 65715) to revise the National Ambient Air Quality Standard (NAAQS) for particulate matter (PM) and ozone.

The proposed revision would greatly expand the two standards. AFBF has the concern that if EPA were to revise the NAAQS for particulate matter and ozone as proposed, the production, processing and distribution of food in the United States would be impacted significantly.

Under the proposed, more stringent NAAQS, it would appear that state governments would have no option but to achieve emissions reductions from many small sources which have not been subject to regulation in the past, and this would have a particularly broad and adverse impact on the agriculture and food processing sector. This revised regulatory approach would multiply significantly the range of potential control options, creating an impact on each segment of the food supply chain.

Section I - Impact on "Farm to the Table" food production and delivery
The United States boasts the finest "farm to table" food distribution system in the world. U.S. consumers spend far less of their personal disposable income on food than consumers in any other industrialized nation. In large part, efficiencies in growing, processing and distributing food (higher productivity and enhanced technology) keep costs to American consumers down.

There is broad consensus that the proposed new NAAQS for fine particles would create new "non-attainment" areas and drive up farm costs, especially in rural areas which currently do not monitor PM levels. More specifically, it has been estimated that the proposed new standards would swell the number of counties and areas that would qualify for "non-attainment" status, representing a dramatic increase in the number of areas that currently are not in compliance.

These new, largely rural, "non-attainment" areas are the core of production agriculture and food processing. Farm mechanization, farming practices, distribution to and from processing and storing facilities and public distribution are likely to be affected by the proposals, thereby compromising the ability of the agricultural sector to continue to provide an abundant, healthy, economical food supply to consumers.

The proposed new standards for particulate matter and ozone could force state and local governments to impose significant new regulatory burdens on farms, grain handlers, mills, transporters and processing plants. The new standards would impact the entire sector either directly through new emission regulations, or indirectly through increased business costs.

Direct Impacts: Additional non-attainment areas mean a greater number of farms, ranches, grain handlers, mills, food processing plants and those who transport the product would become subject to stringent new regulations imposing significant compliance costs. Suggested possible control measures for agricultural production under the particulate matter standard include tighter emission controls on farm equipment. Moreover, the current inability to precisely measure fine particulate matter could result in some areas setting arbitrary limits for when a farmer can enter his field for tillage, harvest of crops or application of fertilizer or crop protection materials.

While agricultural production, processing plants, grain handlers and mills are generally not major emitters of fine particulate matter or precursors of fine particulate matter, many states and localities would be forced by the new standards to target those sectors for tighter regulation. In addition, new regulations could impede the ability to construct new facilities or to expand and modernize existing facilities. Modernization usually leads to improved pollution control/prevention, with a resultant decrease in emissions.

The expedient and economical distribution of finished foods, a critical link in assuring foods from the farm reach consumers' tables, would be impacted by control strategies such as reformulated fuels requirements, engine emission standards, inspection requirements, retrofitting and rebuilding of existing engines and operational restrictions. These control options would jeopardize the efficient system which keeps an abundant and economical supply of fresh and wholesome foods on American and world consumers' tables.

Indirect Impacts: Indirect impacts upon the agricultural and food processing industries may be greater than direct impacts. These industries are heavily dependent upon efficient, affordable transportation from farm to market or processing plant, and from processing plant to market. The proposed new standards could result in major increases in fuel and transportation costs as well as energy and equipment prices. As a result, the economic viability of some producers, grain handlers, millers and processors could be dramatically influenced by these motor fuel and electricity price increases. Increased costs for the agricultural sector in turn would adversely

impact trade and U.S. competitiveness in the world market.

Section II. - Impact on small business
Many agricultural producers fall under the Small Business Administration's definition of "small business." AFBF is concerned EPA has failed to consider the national impact of the proposed standards on small business, which have made a vital contribution to the strength of the U.S. economy.

Section III. - No data for production agriculture's true emissions
Studies are being conducted at the University of California at Davis, Texas A&M and other universities to determine production agriculture's contribution to ambient levels of fine particulate matter. This research needs to be completed before proposals of such magnitude are finalized. Retention of current standards would allow time for necessary study and discussion regarding the impact of the new standards.

Section IV. - USDA Agricultural Air Quality Task Force
Designated under the 1996 Federal Agriculture Improvement and Reform Act (Farm Bill), a United States Department of Agriculture task force has been appointed and has held an initial meeting on this and other air quality issues as they impact the agricultural community. The EPA is a vital part of this task force and AFBF welcomes the discussions and actions that this task force is pursuing.

Section V. - Air quality is improving under current standards
"The National Air Quality and Emission Trends Report, 1995" issued recently by EPA shows that over the past 25 years, emissions and ambient concentrations of the six major air pollutants have decreased nationally by almost 30 percent. Furthermore, the significant reduction in the number of nationwide "non-attainment" areas for ozone from 98 areas in 1990 to 66 areas at the present time and EPA's own forecast of continuing reductions in ozone precursors emissions under current and prospective Clean Air Act programs (such as the Title IV, acid rain program, and Title III, hazardous air pollutants program), provide clear indications that the current standards are promoting improved air quality.

By contrast, the Regulatory Impact Assessment (RIA) of this proposed rule, prepared by EPA, concludes that the costs to implement the proposed new standards could be significantly higher than the benefits to be gained by enforcing the more stringent standards. At best, this analysis provides inconclusive support for proceeding with more stringent regulatory requirements.

Section VI. - Ozone and crop damage
The question of whether reduced levels of ozone will lead to less damage to crops has been posed by the EPA. While the occurrence of ozone-caused crop damage appears to be accepted by the EPA, the question of this damage being at a level of concern is unfounded.

EPA's own Clean Air Scientific Advisory Committee (CASAC) mentions in its closure statements on the secondary standard portion of the staff paper for ozone, that "the panel felt that the absolute values of the numbers in Tables VII-5a-VII-7 are highly uncertain estimates of crop losses and are a result of a propagation of uncertainties. They are rough estimates, and this

should be explicitly stated in this discussion."

If reduced levels of ozone truly would benefit the agricultural community, then there needs to be hard data and more research on this subject before any new decisions are finalized.

In addition, preliminary studies conducted in California suggest that some agricultural crops, such as cotton, may actually act as a "scrubber" or "sink" for ozone and particulate matter precursors, therefore actually cleaning the air of these two pollutants. Again, further research is needed.

Conclusion
These new standards could adversely impact the continued ability of this vital sector to provide an abundant, low-cost food supply, both to the United States and to the world. Because the proposed new NAAQS standards would impact each segment of the food production chain without reliable indication of benefit to public health, AFBF urges EPA to withdraw the proposed standards and initiate a targeted research program to resolve the serious and pertinent questions needed for scientific justification of such proposals.

Farm Bureau appreciates the opportunity to provide you with our comments on proposed regulations. We welcome any opportunity to provide further information regarding AFBF's position on this issue.

Sincerely,

Dean R. Kleckner

Dean R. Kleckner
President

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

April 4, 1996

EPA-SAB-CASAC-LTR-96-006

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

Honoracle Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M. Street SW
Washington, DC 20460

RE: Closure by the Clean Air Scientific Advisory Committee (CASAC) on the Secondary Standard Portion of the Staff Paper for Ozone

Dear Ms. Browner:

A Panel of the Clean Air Scientific Advisory Committee (CASAC) of EPA's Science Advisory Board (SAB) met on March 22, 1995, to review a draft of the primary standard portion of the document entitled *Review of National Ambient Air Quality Standards for Ozone Assessment of Scientific and Technical Information* - OAQPS Staff Paper. At that time, a draft of the secondary standard portion of the document was not completed. In August, 1995, a revised Staff Paper, which included a first draft of the secondary standard portion was sent to the CASAC panel members for review. On September 19 and 20, 1995, the Panel met to complete this review. The Panel members' comments reflect their satisfaction with the improvements made in the scientific quality and completeness of the primary standard portion of the Staff Paper and reached closure on that part (see CASAC Letter Report EPA-SAB-CASAC-LTR-96-002, November 30, 1995). However, the Panel could not come to closure on the secondary standard portion of the Staff Paper which was a first draft. To facilitate further development of this part of the Staff Paper, the Panel members provided detailed comments to your staff. The Panel felt that the suggested revisions were extensive enough to warrant a review of the next draft.

On March 21, 1996, a subset of the Panel, consisting of all four of the Panel members with expertise in ozone effects on vegetation plus three additional CASAC members, met in Research Triangle Park, NC to review a second draft of the secondary portion of the Staff Paper. In addition, a Panel member with expertise in economics

reviewed the Staff Paper and provided written comments. Overall, the comments from the Panel members reflected their satisfaction that the Staff Paper was much improved; however, the verbal and written comments provided to your staff indicated that important, additional modifications are still required. Nevertheless, it was the consensus of the Panel that an additional review of the document by the Panel was not necessary. Consequently, the majority of the Panel agreed to come to closure on the Staff Paper assuming that the Agency would incorporate the Panel's latest comments. It was the opinion of six of the seven members of the Panel who were present that the Staff Paper will provide an appropriate scientific basis for making regulatory decisions concerning a secondary ozone standard once the additional changes are incorporated. The additional modifications are summarized below.

It should be pointed out that the Panel members all agreed that damage is occurring to vegetation and natural resources at concentrations below the present 1-hour national ambient air quality standard (NAAQS) of 0.12 ppm. The vegetation effects experts were in agreement that plants appear to be more sensitive to ozone than humans. Further, it was agreed that a secondary NAAQS, more stringent than the present primary standard, was necessary to protect vegetation from ozone. However, agreement on the level and form of such a standard is still elusive for a number of reasons.

The first issue is the level of uncertainty associated with the crop loss risk assessment presented in Tables VII-5a-d through VII-7 of the Staff Paper. While some of the sources of uncertainty are addressed earlier in the Staff Paper, other sources of uncertainty are not accressed at all. The estimates in these Tables should only be presented as rough estimates for a number of reasons. First, the dose-response functions are based upon open-top chamber studies which have the advantage of providing the least amount of environmental modification of any outdoor chamber, but, nevertheless, they still alter ambient microclimate conditions which will introduce uncertainty. In these studies, plant response to ozone has been optimized under conditions which do not reflect the real-life ambient field conditions. Two of the plant experts said that the open-top chamber experiments by their very design and execution produced results that overestimated the effects of ozone on plant yield. The other two experts agreed that the open-top chambers do alter the environment in the chamber with respect to ambient field conditions but did not agree with there being a positive bias. Research has not yet provided methods that clearly are better than open-top chambers for establishing ozone dose-response relationships for a wide variety of crops. Second, the estimated exposures are based on a non-peer-reviewed, empirical model which has not been subjected to any performance evaluation. In addition,

insufficient details are given either in the Staff Paper or the unpublished Agency report for anyone to perform an evaluation. Third, the estimated exposures are then extrapolated to hypothetical scenarios where various secondary NAAQS are attained. Details of this extrapolation procedure are also insufficient to judge the appropriateness of the procedure. Fourth, the exposure estimates are then extrapolated to the entire determinous U.S. using a Geographic Information System (GIS) which is based on an unpublished, non-peer-reviewed, internal EPA memorandum that contains insufficient details to adequately evaluate the GIS. The exposure estimates and the dose-response function estimates are then input into the economic models which introduce additional uncertainties. Furthermore, the losses are computed from an assumed 12-hr. background ozone concentration of 0.025 ppm which is too low and will over-inflate the crop loss estimates. A more reasonable 12-hr. daylight, summertime background is more likely closer to the 8-hr. background of 0.03-0.05 ppm. As a result, the Panel felt that the absolute values of the numbers in Tables VII-5a-VII-7 are highly uncertain estimates of crop losses and are a result of a propagation of uncertainties. They are rough estimates, and this should be explicitly stated in this discussion. The Panel believes, however, that these Tables can be of some use in identifying rough relative incremental benefits associated with a given NAAQS as long as it is recognized that small differences in benefits may have no significance because of these uncertainties.

A related issue is the estimated yield losses and seedling biomass losses displayed on the maps in Appendix E of the Staff Paper. Since these are also based on the results of open-top chamber experiments as well as the results of the GIS technology approach, the uncertainties are large. The concern here is that the maps will be used out of context and the caveats ignored. The limitations and uncertainties of the data need to be clearly stated in the legend of each map.

The SUM06 standard reflects a change in thinking over the current 1-hour standard with respect to how plants respond to ambient ozone exposure. This proposed form of the standard implicitly recognizes that vegetation response to ambient ozone is cumulative. However, there is disagreement over whether this is the best form for a cumulative standard and what the level of the standard should be to protect vegetation from damage by ozone. One of the Panel's ecology experts thinks the form and the range of between 25 to 38 ppm-hours proposed by the Agency is appropriate. A second expert thinks the form proposed by the Agency is appropriate and biologically based, but feels that a level of 20 ppm-hours is necessary to adequately protect natural resources. The other two experts are uncomfortable with a SUM06 form because they feel it lacks a biological basis. One member stated that he feels very uncomfortable with SUM06 and would not want to defend it because he feels there is too much

uncertainty associated with its derivation. The fourth expert is concerned that a SUM06 form is unnecessarily complicated, and the level proposed by the Agency would not eliminate ozone damage. Instead, he proposes that the 1-hour average ozone should not exceed 0.05 ppm for more than one hour between the hours of 0700-1500. In his written comments, the Panel's economist noted that the welfare benefits of a secondary standard depend on the decision regarding the primary standard. For example, he points out that if the primary standard remains at 0.12 ppm for 1-hour, or is changed to an 8-hour standard of 0.09 ppm with one allowable exceedence, Table VII-5a suggests potentially significant incremental benefits associated with a secondary standard based on SUM06. He further states that if the primary standard is set at 0.07 or 0.08 ppm with one exceedence, there is little to be gained by establishing a separate secondary standard.

Although the three remaining CASAC members were neither biologists or economists, they offered their opinion on the secondary standard proposals. Two think the form proposed by the Agency is appropriate. One thinks that the level proposed by the Agency is appropriate, while the other feels that the Administrator's discretion should be broader than the range presented in the Staff Paper. One of these members pointed out, however, that the Staff Paper does not make it clear enough that the SUM06 standard as proposed is a practical choice being made as to the level of effects that will be tolerated and not a level that will prevent effects from occurring. The third is uncomfortable with SUM06 and based on the estimates in Tables VII-5a-VII-7, recommends an 8-hour standard at the same level as the new primary standard. The three members also concurred that given the crudeness of the risk assessment estimates, policy decisions cannot be based firmly on science.

A number of the Panelists offered their insights as to why there are such divergent opinions on the recommended form and level of the standard. The main issues are the lack of sufficient rural ozone data, and the lack of relevant plant exposure studies. There are serious deficiencies in terms of the distribution of monitoring sites, particularly in rural areas that prevent us from accurately assessing exposure once ozone damage is observed. The Panel is in agreement that plants are being damaged by ozone and that the current secondary standard is not sufficiently protective, but there remain important limitations to our understanding of the extent of the response of vegetation to ozone under field conditions. Five years from now, if we do not have the results of research coupling ozone air quality and plant biology under conditions more representative of ambient field conditions, to avoid the shortcomings of the open-top chamber experiments, then we will continue to be hampered by our inability to come to consensus on the levels of air quality that are protective of vegetation and ecosystems

at the most reasonable cost. In addition, a number of Panelists expressed the importance of knowing the consequences of decisions concerning National Ambient Air Quality Standards. Once a decision is made to change the standard or to maintain the status quo, we must be able to determine, by appropriate monitoring and research, what the consequences will be in terms of ambient air quality and affects on vegetation and ecosystems.

In summary, a majority of the Panel has come to closure on the secondary part of the ozone Staff Paper despite the desire of the Panel for additional significant revisions. These revisions have been communicated to your staff by this letter and in written comments by individual Panel members. The Panel trusts that your staff will address these concerns.

CASAC would appreciate being kept informed of progress on establishing a revised or new ozone standard, and plans for research on ozone affects. Please do not hesitate to contact me if CASAC can be of further assistance in this matter. We look forward to seeing the final version of the secondary standard portion of the Staff Paper.

Sincerely,

George T. Wolff

Dr. George T. Wolff, Chair
Clean Air Scientific Advisory Committee

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

April 4, 1996

EPA-SAB-CASAC-LTR-96-006

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
401 M. Street SW
Washington, DC 20460

RE. **Closure by the Clean Air Scientific Advisory Committee (CASAC) on the Secondary Standard Portion of the Staff Paper for Ozone**

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reviewed the Staff Paper and provided written comments. Overall, the comments from the Panel members reflected their satisfaction that the Staff Paper was much improved; however, the verbal and written comments provided to your staff indicated that important, additional modifications are still required. Nevertheless, it was the consensus of the Panel that an additional review of the document by the Panel was not necessary. Consequently, the majority of the Panel agreed to come to closure on the Staff Paper assuming that the Agency would incorporate the Panel's latest comments. It was the opinion of six of the seven members of the Panel who were present that the Staff Paper will provide an appropriate scientific basis for making regulatory decisions concerning a secondary ozone standard once the additional changes are incorporated. The additional modifications are summarized below.

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The first issue is the level of uncertainty associated with the crop loss risk assessment presented in Tables VII-5a-d through VII-7 of the Staff Paper. While some of the sources of uncertainty are addressed earlier in the Staff Paper, other sources of uncertainty are not addressed at all. The estimates in these Tables should only be presented as rough estimates for a number of reasons. First, the dose-response functions are based upon open-top chamber studies which have the advantage of providing the least amount of environmental modification of any outdoor chamber, but, nevertheless, they still alter ambient microclimate conditions which will introduce uncertainty. In these studies, plant response to ozone has been optimized under conditions which do not reflect the real-life ambient field conditions. Two of the plant experts said that the open-top chamber experiments by their very design and execution produced results that overestimated the effects of ozone on plant yield. The other two experts agreed that the open-top chambers do alter the environment in the chamber with respect to ambient field conditions but did not agree with there being a positive bias. Research has not yet provided methods that clearly are better than open-top chambers for establishing ozone dose-response relationships for a wide variety of crops. Second, the estimated exposures are based on a non-peer-reviewed, empirical model which has not been subjected to any performance evaluation. In addition,

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Crop losses uncertain

A related issue is the estimated yield losses and seedling biomass losses displayed on the maps in Appendix E of the Staff Paper. **Since these are also based on the results of open-top chamber experiments as well as the results of the GIS technology approach, the uncertainties are large.** The concern here is that the maps will be used out of context and the caveats ignored. The limitations and uncertainties of the data need to be clearly stated in the legend of each map.

Yield Losses uncertain

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Although the three remaining CASAC members were neither biologists or economists, they offered their opinion on the secondary standard proposals. Two think the form proposed by the Agency is appropriate. One thinks that the level proposed by the Agency is appropriate, while the other feels that the Administrator's discretion should be broader than the range presented in the Staff Paper. One of these members pointed out, however, that the Staff Paper does not make it clear enough that the SUM06 standard as proposed is a practical choice being made as to the level of effects that will be tolerated and not a level that will prevent effects from occurring. The third is uncomfortable with SUM06 and based on the estimates in Tables VII-5a-VII-7, recommends an 8-hour standard at the same level as the new primary standard. The three members also concurred that given the crudeness of the risk assessment estimates, policy decisions cannot be based firmly on science.

Why so much unfortunately!

A number of the Panelists offered their insights as to why there are such divergent opinions on the recommended form and level of the standard. **The main issues are the lack of sufficient rural ozone data, and the lack of relevant plant exposure studies. There are serious deficiencies in terms of the distribution of monitoring sites, particularly in rural areas that prevent us from accurately assessing exposure once ozone damage is observed.** The Panel is in agreement that plants are being damaged by ozone and that the current secondary standard is not sufficiently protective, but there remain important limitations to our understanding of the extent of the response of vegetation to ozone under field conditions. Five years from now, if we do not have the results of research coupling ozone air quality and plant biology under conditions more representative of ambient field conditions, to avoid the shortcomings of the open-top chamber experiments, then we will continue to be hampered by our inability to come to consensus on the levels of air quality that are protective of vegetation and ecosystems

at the most reasonable cost. In addition, a number of Panelists expressed the importance of knowing the consequences of decisions concerning National Ambient Air Quality Standards. Once a decision is made to change the standard or to maintain the status quo, we must be able to determine, by appropriate monitoring and research, what the consequences will be in terms of ambient air quality and effects on vegetation and ecosystems.

In summary, a majority of the Panel has come to closure on the secondary part of the ozone Staff Paper despite the desire of the Panel for additional significant revisions. These revisions have been communicated to your staff by this letter and in written comments by individual Panel members. The Panel trusts that your staff will address these concerns.

CASAC would appreciate being kept informed of progress on establishing a revised or new ozone standard, and plans for research on ozone effects. Please do not hesitate to contact me if CASAC can be of further assistance in this matter. We look forward to seeing the final version of the secondary standard portion of the Staff Paper.

Sincerely,

George T. Wolff

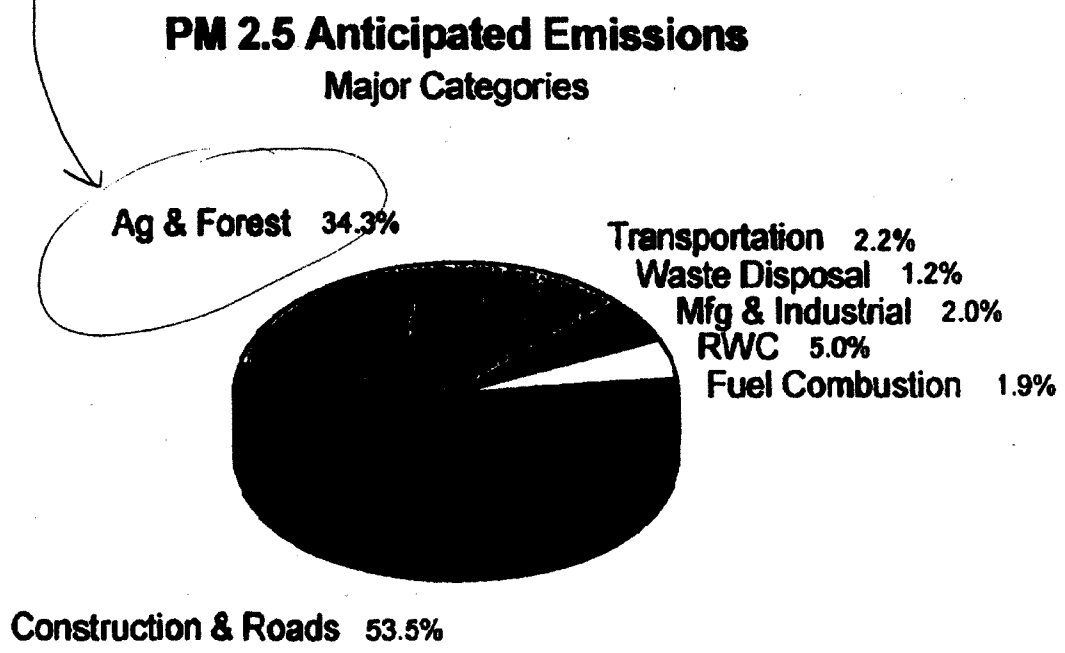
Dr. George T. Wolff, Chair
Clean Air Scientific Advisory Committee

Air Quality and Agriculture Issues

Sally Shaver, Director
Air Quality Strategies
and Standards Division (EPA)

March 5 and 6, 1997

EPA chart


PM 2.5 Anticipated Emissions
Major Categories
Ag & Forest 34.3%
Transportation 2.2%
Waste Disposal 1.2%
Mfg & Industrial 2.0%
RWC 5.0%
Fuel Combustion 1.9%
Construction & Roads 53.5%

Implications of a revised PM standard

- PM-10
  - Agriculture contribution 24%
  - Continue with coarse particle control under the proposed PM-10 standard
- PM-2.5
  - Agriculture contribution 29%
  - Primary focus will be on combustion sources and secondarily formed PM

PREPARED STATEMENT OF PAUL HANSEN, EXECUTIVE DIRECTOR, IZAAK WALTON LEAGUE OF AMERICA

Mr. Chairman and Members of the Subcommittee: I am Paul Hansen, Executive Director of the Izaak Walton League of America, which is celebrating its 75th year of working to conserve, maintain, protect and restore the soil, forest, water and other natural resources of the United States. I appreciate having the opportunity to talk with you today about the Environmental Protection Agency's proposal for new national air quality standards for ozone and fine particulate matter, commonly referred to as $PM_{2.5}$.

Protection of our nation's air quality is a part of the Izaak Walton League's mission and an issue of vital importance to League members, many of whom live in the nation's agricultural communities. We have worked on clean air issues since the first Federal Air Pollution Act, which was passed during the Eisenhower Administration. With the adoption of new air quality standards just months away, the League is concerned that the health, environmental and economic benefits that new standards would provide be understood, recognized and considered as you review this critical decision.

Today, I want to touch on a few of the benefits this new standard would realize for the health of our people and our natural environment, but I especially want to implore you to consider the findings of the U.S. Department of Agriculture's National Crop Loss Assessment Network, which was released during the Reagan Administration. We were involved in the NCLAN study, and cosponsored a symposium in 1982, with the Boyce Thompson Institute at Cornell University, at which many of the findings were released and discussed. I personally conducted a literature review of the effects of air pollution on crops in 1990, a summary of which is available here today for your consideration.

You know that the new air quality standards would protect public health by preventing approximately 15,000 premature deaths and 250,000 to 400,000 illnesses each year. The proposed ozone standard of .08 ppm would provide much needed health protection to anyone who spends time outdoors working, exercising or relaxing. This includes, of course, farm owners, operators and employees. The particulate matter standard for $PM_{2.5}$ would protect, among others, anyone with heart or lung disease. Most importantly, both standards would improve protections for our children's health.

You also know that new limits on ozone and fine particulate matter pollution would further reduce emissions of air pollutants that deposit on our rivers, lakes and streams and degrade water quality necessary for wildlife, fisheries, and water-based recreation. As you know, ozone and particulate matter pollution are secondary, not primary pollutants. This means that they are not emitted directly but instead are created from a mixture of primary pollutants including nitrogen oxides and sulfur dioxides. By reducing emissions of these primary pollutants, the new standards would help to prevent the acidification of our rivers, lakes, streams, and other special aquatic ecosystems such as the Chesapeake Bay.

Most critical to the responsibilities of this Committee, the new ozone standard would provide millions of dollars in agricultural benefits each year. At air pollution levels well below those that exist in our air today, ozone can reduce the productivity of commodity crops such as corn and soybeans by 10 percent. This means that dirty air costs our country approximately one billion bushels of corn and more than two hundred million bushels of soybeans each year—at today's prices almost three billion dollars in revenues.

It is well-established in the literature that the effects of ozone on crops is very insidious, and, in most cases, invisible. With soybeans, for example, there are no fewer beans, but lighter beans. A 10-percent reduction, which can be common at ozone levels found throughout much of the soybean growing region, while highly significant in terms of yield, would be effectively invisible—even to the trained eye.

In the last 2 years, three groups of experts on ozone's vegetative impacts have reconfirmed the seriousness of ozone's impacts on commodity crops, forests, and other vegetation, which were first measured by the National Crop Loss Assessment Network in 1982. A workshop sponsored by the Southern Oxidants Study in 1995 convened agricultural, forest, and ecological scientists with extensive experience studying the effects of ozone on ecosystems to discuss the need for a new ozone standard. The Workshop recommended that EPA adopt a seasonal secondary standard that would provide vegetation with additional protection during the growing season.

More recently, the Department of the Interior recommended that EPA adopt a more protective secondary standard because the proposed primary standard of .08 ppm was not adequate to protect natural and cultural resources.

Finally, the Clean Air Scientific Advisory Committee (CASAC) that reviewed the research behind the proposed standards advised EPA that a secondary standard, more stringent than the primary, was needed to protect vegetation from ozone.

I know that concern has been expressed regarding the cost of implementing a new $PM_{2.5}$ standard, particularly in agricultural areas, and 1 would like to close by addressing that issue.

First, it is essential that our air quality standards be set at levels that are protective of human health, not at levels that regulated industries and others consider cost-effective.

Second, the new particulate matter standard applies to $PM_{2.5}$, not PM_{10}. EPA has not recommended any tightening of levels of PM_{10} pollution. The distinction is important because almost all $PM_{2.5}$ is a product of combustion and almost all PM_{10} is created by earth moving activities such as construction, mining, and agricultural practices like tilling.

Third, on most farms, the primary source of combustion is diesel fueled farm equipment. This equipment is responsible for a very small amount of the primary pollutants that create $PM_{2.5}$. The amounts of these primary pollutants created by farm equipment are so small they are insignificant when compared to emissions from other $PM_{2.5}$ sources. Farm equipment creates about 1 percent of national nitrogen oxide emissions and almost no sulfur dioxide emissions.

Finally, the history of pollution controls strongly suggests that even if controls on diesel fueled vehicles become necessary, these controls will cost far less than predicted. Reductions in sulfur dioxide emissions, for example, which cost less than $100 per ton today were predicted to cost as much as $1,500 per ton. Reduced crop yields are much more likely than tighter pollution controls to negatively impact a farmer's bottom line.

In closing I would like to again thank you for the opportunity to address the proposed new standards' agricultural impacts and to shed light on one of the hidden victims of our nation's polluted air, the American farmer.

NEW STANDARDS WILL IMPOSE FEW BURDENS ON THE FARMER

The Izaak Walton League believes the impact that these standards will have on our nation's agriculture industry have been mis-characterized by some. Industry opponents to the new $PM_{2.5}$ standard, for example, claim the new standard will create a horrible regulatory burden for farmers. These opponents are assuming that EPA will target the same farming activities for $PM_{2.5}$ as it did in developing strategies for controlling PM_{10}. However, this assumption is mistaken.

EPA's principle interest in implementing the new air quality standards is to bring areas of non-attainment into attainment. Most projected non-attainment areas are urban areas where fine particulate matter pollution is a product of combustion. Therefore, the major targets of regulatory focus are very likely to be sources of combustion in urban areas: electric utilities, buses, and large commercial boilers, for example.

The changes EPA is proposing to the PM_{10} program—which do *not* include a tightening of PM_{10} pollution limits—actually result in fewer regulatory burdens on agricultural activities. For example, by proposing a switch to a "98th percentile" form for measuring compliance with the PM_{10} standard, EPA is proposing to allow more than six exceedances every year to be "excused" instead of just one. In comments critical of this element of EPA's proposal, the California Air Resources Board calculated that in the Great Basin Valley peak PM_{10} levels 68 percent above the standard would be legal under the new proposal.

Finally, there has been testimony in the U.S. House of Representatives that the new $PM_{2.5}$ standard will also affect farmers who use nitrogen-based fertilizers and, because of the volatilizations of ammonia, dairies with manure lagoons. In reality, combustion sources such as factory boilers and electric utilities emit many times the level of $PM_{2.5}$ particles than do manure lagoons. They are not likely to be regulated under the State Implementation Plans developed to implement these standards.

PREPARED STATEMENT OF KEVIN FENNELLY, MD, STAFF PHYSICIAN, DIVISION OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH SCIENCES, NATIONAL JEWISH MEDICAL AND RESEARCH CENTER

Mr. Chairman and Members of the Subcommittee: Thank you for the opportunity to speak with you today regarding the particulate matter standard proposed by the Environmental Protection Agency (EPA). My name is Kevin Fennelly; I am an academic physician at the National Jewish Medical and Research Center in Denver, Colorado. I am board-certified in pulmonary medicine and in occupational-environ-

mental medicine, and my time is evenly divided between patient care and clinical-epidemiological research. Most of the patients I see have asthma or chronic obstructive pulmonary disease (COPD), although I care for patients with a wide spectrum of more unusual respiratory diseases. My research interests include the epidemiology of the health effects of particulate air pollution, so I am familiar with the scientific literature in this area.

I am testifying today as a concerned physician, scientist, and citizen. I support the EPA proposal, although a more stringent standard would provide additional public health benefits. I wish to emphasize three points. (I) Particulate air pollution causes human suffering, not just statistics. (II) There is biological plausibility to support the epidemiological findings of adverse health effects associated with particulate air pollution. (III) The risk of adverse health effects due to particulate air pollution is comparable to other risks which our society has not found acceptable.

I. PARTICULATE AIR POLLUTION CAUSES HUMAN SUFFERING, NOT JUST STATISTICS

In discussing these issues with our local and State leaders, I realized that we physicians and scientists have not done an ideal job of communicating the meaning of recent scientific studies on particulate air pollution. The data have often been expressed in very abstract terms which are difficult to understand. My primary goal today is to try to bridge the gap between the scientific data and the clinical effects. I hope to prevent you from being numbed by all the numbers which you have undoubtedly seen, and to recall that behind all those statistics are people suffering from very real diseases.

As a physician specializing in lung diseases, I have seen patients who report worsening of their asthma symptoms on days of visible air pollution in Denver, Phoenix, Los Angeles, and the San Francisco Bay Area. These patients have told me of this association after a nonspecific inquiry about the triggers of their asthma symptoms, and they have not been aware of my research interest in air pollution. Colleagues have reported similar encounters. In Denver, our air pollution is predominated by particulate matter, so at least for our local patients, particulate air pollution is likely to contain the offending agent(s). Asthma is a common disease characterized by symptoms to multiple triggers, including respiratory infections, cold air, exercise, and other factors, including air pollution. Because of this, it is impossible in any one patient to quantify how much air pollution contributes to the disease. This speaks to the need for epidemiological studies of groups of individuals to assess the relative contribution of factors such as air pollution.

Aside from asthmatics, another group susceptible to the effects of particulate air pollution are the elderly with heart or lung disease. Again, since these diseases are so common, it is impossible for any one physician on any 1 day to notice changes in the pattern of illness or death which might be attributable to particulate air pollution. Even with the hundreds of deaths which occurred during the air pollution disaster in London in 1952, doctors did not appreciate the full magnitude of that public health disaster until the epidemiologic data were available.

I have been disturbed by comments in the lay literature which have trivialized the occurrence of respiratory symptoms associated with air pollution. Breathing is our most basic notion Without breath there is no life, and it should be understandable that shortness of breath can be a distressing symptom. Allow me to suggest a simple exercise for those of you who may be fortunate enough to have escaped experiencing shortness of breath yourself or to have observed it in a family member. Simply take a drinking straw and breathe through it for several minutes, or better yet, try to walk about and climb some stairs. Then imagine feeling that way for hours or days. It is not a trivial discomfort.

The other disturbing suggestion I have heard is that patients with lung diseases should simply medicate themselves more to cope with air pollution. This is illogical and violates good medical practice. As an occupational pulmonologist, I engage considerable resources removing patients from exposures which may be causing or aggravating their asthma. In the case of urban air pollution, it is obviously impossible for patients to avoid breathing the air in their community. Although inhaled bronchodilator medicines may be able to relieve symptoms temporarily, ongoing inhalation exposure will continue to aggravate the inflammation in the bronchial tubes which characterizes asthma and COPD. With more severe exacerbations, patients may have to use corticosteroid tablets or injections, which can have serious adverse effects if used repeatedly.

II. THERE IS BIOLOGICAL PLAUSIBILITY TO SUPPORT THE EPIDEMIOLOGICAL FINDINGS OF ADVERSE HEALTH EFFECTS ASSOCIATED WITH PARTICULATE AIR POLLUTION

I will defer to Dr. Carl Shy's expertise in epidemiology to review the large numbers of studies which have found adverse health effects associated with particulate air pollution, but I wish to offer a few observations. Critics of these studies have suggested that they are inconclusive or that they have been done by a small group of biased researchers from Harvard. In fact, there are now a large number of studies of various designs which have been done in various cities, countries, and climates, and by various investigators studying multiple outcomes: death rates, hospitalizations, emergency department visits, pulmonary function changes, asthma medication use, and symptoms. There has been a striking consistency in the findings of these studies. There have been a few studies which have not found similar results, but these have typically suffered from designs and methods which resulted in a lack of statistical power or the lack of a biologically plausible hypothesis.

Some critics of the EPA proposal have suggested that epidemiological studies are not valid science or use some sort of statistical sleight-of-hand. Advances in computing power and in statistical methods have improved the science of modern epidemiology considerably, which is similar to the advances due to improved technology in other fields. It is true that there have been epidemiologic studies of various suspected hazards which have resulted in associations which were later found to be spurious. In those cases the cause and effect relationship was readily dismissed after additional epidemiological and toxicological studies did not support the findings. However, this surely cannot be an indictment against the field of epidemiology; similar processes occur in every scientific field. In summary, it is highly unlikely that the epidemiological findings are due to chance or some other aberrations.

A common criticism expressed in the lay press has been the small magnitude of the effects of the epidemiological studies. There have been references to the opinions of some scientists who only "accept" relative risks over 2 or 3 (or some other arbitrary number) in order to consider an association "significant". In fact, there is no consensus or "gold standard" in the scientific community for any criteria in this regard. Such criteria might be useful as a screen in assessing the value of one or even a few studies on a given subject. However, when there is a large body of literature which has demonstrated consistent results, as is the case regarding the health effects of particulate air pollution, we must accept the data as they are. The magnitude of the effects are indeed small at current levels of particulate air pollution, but they are consistent with the effects which occurred during severe air pollution episodes, such as in London, 1952. Indeed, this point satisfies another criteria for establishing a cause-and-effect relationship: a reasonable exposure-response relationship.

The impact on the public health is determined not only by the magnitude of the effect, but also by how many people are exposed and how frequently they are exposed. Highly toxic environmental hazards easily gain the attention of the media and the public. Conversely, exposure to urban air pollution is such a common experience that most people perceive very little risk. However, it can be as serious a public health risk, albeit much more insidious, since there are large numbers of susceptible people frequently exposed to low concentrations of pollutants. Most of us were shocked at the accidental release of methyl isocyanate in Bhopal, India in 1984. There were at least 2000 deaths from that disaster [1], but the number of individuals dying from particulate air pollution each year clearly exceeds that number.

A common criticism of the EPA proposal for the particulate matter standard is that the epidemiological studies are not supported by biological plausibility. Although we still have much to learn, this is not true. In the air pollution disaster in Donora, PA of 1948, there were symptoms in 88 percent of those with asthma, 77 percent of those with heart disease, and 79 percent of those with chronic bronchitis[2]. There were 12 deaths in the Donora Borough during that week, which was six times the expected rate. Autopsies were performed on three of these patients. All three had evidence of capillary dilatation, edema, and hemorrhage in the lung with purulent bronchitis and bronchiolitis, which are inflammatory changes in the medium-to-large and small airways, respectively. All three of these patients had evidence of chronic cardiovascular disease. Similarly, in the killer fog of London in 1952, approximately 300 (60 percent) of over 500 autopsies demonstrated *both* heart and lung disease[3]. Thus, the pathological data were consistent with the concurrent and more recent epidemiological findings of increased deaths due to heart and lung diseases.

Godleski and colleagues[4] recently presented preliminary findings of an inhalation toxicology study which was coherent with these pathological findings. They exposed rats with experimentally induced chronic bronchitis to concentrated urban air

particulates. Those animals had a higher death rate (37 percent) than the controls (0 percent) as well as airway inflammation and marked constriction of the bronchial tubes.

Other animal studies have demonstrated lung inflammation and injury due to particulate matter, especially with very small particles described as "ultrafine"[5]. There are a growing number of reports of investigations of the basic biological mechanisms responsible for this inflammatory response, including free radical activity[6], prostaglandins[7], and endotoxin-induced activation of genes for cytokines, or chemical messengers[8]. Another recent study[9] found that there is a marked increase in particle deposition in subjects with chronic obstructive lung disease, which may help explain the increased susceptibility of these individuals to the effects of particulate air pollution.

Although much more research is needed to elucidate the biological mechanisms causing the effects of particulate air pollutants, these early studies are already producing exciting results supporting the biological plausibility of the epidemiological findings. Some critics of the EPA proposal have called for more scientific certainty before taking action. As a pulmonologist, these arguments seem to echo the history of the science and public policy regarding cigarette smoking. Early epidemiological studies identified cigarette smoking as a risk factor for lung cancer and cardiovascular disease, but the strategy of the tobacco industry for years has been to repeatedly demand that more research is needed to confirm the hazards of cigarette smoking. Although we have learned a tremendous amount about the adverse health effects of cigarette smoking, we still do not know with absolute certainty exactly how smoking induces cancer and cardiovascular disease. However, few reasonable people now question the deleterious effects of cigarette smoking. Absolute certainty can be achieved only with complete convergence and consistency of all studies in all disciplines, including epidemiology, inhalation toxicology, dosimetry, and others. This has never happened, and it is highly unlikely that it will ever happen due to the nature of science as a human endeavor.

III. THE RISK OF ADVERSE HEALTH EFFECTS DUE TO PARTICULATE AIR POLLUTION IS COMPARABLE TO OTHER RISKS WHICH OUR SOCIETY HAS NOT FOUND ACCEPTABLE

Just as "absolute certainty" is impossible, there is no such thing as "zero risk." From a regulatory perspective, I can appreciate that this scientific literature is disturbing since there is no suggestion of a threshold concentration associated with these health effects. Therefore, the critical question becomes one of "acceptable risk" and of our societal values. Just as there is no gold standard for what constitutes a "significant" relative risk, there is no consensus as to what is an "acceptable risk" in our society. However, there are precedents suggesting at least a reasonable range. In the history of regulatory action in the U.S., the EPA and other agencies have often regulated hazards if the cancer risk were greater than 1 per 100,000[10]. The Clean Air Act Amendments of 1990 mandated that the EPA regulate hazardous air pollutant emissions to reduce the lifetime cancer risk if it finds such risk to be higher than one in one million (See Sec. 112(f)(2)). In 1978, the Supreme Court suggested that an occupational risk of cancer due to benzene exposure of 100 per 100,000 warranted regulatory consideration[11]. Thus, there is a range of lifetime risks for cancer from 100 per 100,000 to 1 per 1,000,000 which history suggests is not "acceptable" to our society. These data refer to risks for cancer, but it seems that an increased risk of death from heart or lung disease should be considered the same as an increased risk of death from cancer. I would like to suggest an approach to help understand and communicate this issue: the use of incidence rates. EPA has typically performed risk assessments of carcinogenic hazards and expressed the risk in terms of deaths per 100,000 population. A similar metric is used frequently in describing infectious disease risks, but I have not seen it used to describe risks from exposures to air pollution.

For example, to estimate the number of deaths attributable to PM_{10} in Denver, I assumed (1) a threshold effect of 30 mcg/m3 and (2) a 3.4 percent increase in respiratory deaths and a 1.4 percent increase in cardiac deaths for each 10 mcg/m3 increase in PM_{10} (average estimates suggested by Dockery and Pope[12]). Using the daily count of deaths and the daily PM_{10} concentrations for the city of Denver from 1990–92, I thus calculated 57 deaths, or an average of 19 cardiopulmonary deaths per year attributable to particulate air pollution. Since the population of the city of Denver in 1990 was 467,652, the annual crude cardiopulmonary mortality rate attributable to PM_{10} is 19/467,652, or 4 per 100,000. Since there were 1,745 cardiopulmonary deaths from 1990–92, 3.3 percent (57/1745) were attributable to PM_{10}. This conservative estimate is consistent with Lipfert's recent estimate that air pollution may account for 3–5 percent of deaths in affected urban areas; his esti-

mate included lung cancer deaths as well.[13] If the annual risk of death due to particulate air pollution is thus conservatively estimated at 4 per 100,000, then the cumulative risk over only 10 years of residence in this mildly polluted urban area would be 40 per 100,000. I also calculated similar risks for Philadelphia or Los Angeles using data provided in the EPA Staff Paper.[14] (See tables 1 and 2.) These estimates are substantantially larger, at 23 and 25 per 100,000 population per year respectively, or 230 to 250 per 100,000 population over 10 years. Thus, the risk of acute cardiopulmonary death associated with particulate air pollution over a *decade* is greater than the "unacceptable" *lifetime* risk of cancer discussed above.

These risk estimates obviously do not include the many other nonfatal health effects of particulate air pollution, some of which are listed in tables 1 and 2. Although much emphasis has been placed on the studies of increased deaths associated with particulate air pollution, we know that mortality is only the "tip of the iceberg", i.e., that there are probably many more less serious adverse health effects if an exposure is able to produce death[15]. (See figure 1.) Unfortunately, there is not one composite measure which sums the many fatal and nonfatal health effects of an exposure such as particulate air pollution.

Such a discussion of quantitative risk estimates also does not include the qualitative aspects of risks associated with air pollution which the public has not found acceptable, such as these exposures being involuntary, uncontrollable, and affecting children[16].

IV. SUMMARY

These issues are extremely complex, and in our struggles to be objective by providing quantitative data, it is easy to become numbed by the numbers. When I see patients who have increased respiratory symptoms on days of high air pollution, they sometimes ask me why nobody is doing anything to improve Denver's "Brown Cloud". I try to reassure them that great improvements in air quality have been achieved over the last two decades. However, I think that we need to heed the medical maxim: "Listen to the patient." Behind the statistics are real people suffering with real symptoms. I congratulate the EPA in its review of the recent scientific literature and in recognizing the importance of $PM_{2.5}$. There *are* adequate data to support more stringent regulation of particulate air pollution, and the lack of "certainty" should not be an excuse for inaction. We could improve the public health by implementing even more protective standards, such as those proposed by the American Lung Association. At minimum, I urge you to support the proposed changes in the particulate air pollution standard as proposed by the Environmental Protection Agency.

Thank you for this opportunity to share my concerns.

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TABLE 1

Annual Risk of Health Effects Associated with Particulate Air Pollution: Philadelphia, PA 1992-93
(Events per 100,000 population at risk)
Calculated from Data in EPA 1996 Staff Paper: EPA-452 \ R-96-013

Health Effect	Population	Current PM10	Current PM2.5	Proposed 15 mcg/yr 50 mcg/d	Proposed 15 mcg/yr 25 mcg/d
Total Mortality (short-term exposure)	1,590,000	14	23	16	6
Total Mortality (long-term exposure)	1,590,000	N/A	58	25	0
Total Respiratory Hospital Admissions	1,590,000	N/A	16	11	5
Elderly Respiratory Hospital Admissions	241,000	104	N/A	N/A	N/A
Elderly Hospital Admissions for Chronic Obstructive Pulmonary Disease	241,000	50	N/A	N/A	N/A
Elderly Hospital Admissions for Prednisone	241,000	33	N/A	N/A	N/A
Elderly Hospital Admissions for Ischemic Heart Disease	241,000	33	29	21	8
Elderly Hospital Admissions for Congestive Heart Failure	241,000	46	42	29	12
Cases of Lower Respiratory Symptoms in Children	103,000	9,708	10,680	6,796	2,913
Days of Asthma Symptoms in Children	3,900	410,256	N/A	N/A	N/A
M.D. Diagnosed Bronchitis in Children	62,000	306	N/A	N/A	N/A

N/A = Data not available.

TABLE 2

Annual Risk of Health Effects Associated with Particulate Air Pollution: Los Angeles, CA 1995
(Events per 100,000 population at risk)
Calculated from Data in EPA 1996 Staff Paper: EPA-452\R-96-013

Health Effect	Population	Current PM10	Current PM2.5	Proposed 15 mcg/yr 50 mcg/d	Proposed 15 mcg/yr 25 mcg/d
Total Mortality (short-term exposure)	3,640,000	22	25	9	3
Total Mortality (long-term exposure)	3,640,000	N/A	80	N/A	N/A
Total Respiratory Hospital Admissions	3,640,000	N/A	33	11	4
Elderly Respiratory Hospital Admissions	322,000	332	N/A	N/A	N/A
Elderly Hospital Admissions for Chronic Obstructive Pulmonary Disease	322,000	137	N/A	N/A	N/A
Elderly Hospital Admissions for Pneumonia	322,000	130	N/A	N/A	N/A
Elderly Hospital Admissions for Ischemic Heart Disease	322,000	81	50	19	6
Cases of Respiratory Symptoms in Children	282,000	90	56	19	6
Days of Asthma Symptoms in Children	10,700	1,074,766	N/A	N/A	N/A
M.D. Diagnosed Bronchitis in Children	166,000	3,066	N/A	N/A	N/A
Days of Asthma Symptoms in Afr-Am Children	1,800	400,000	N/A	N/A	N/A

N/A = Data not available.

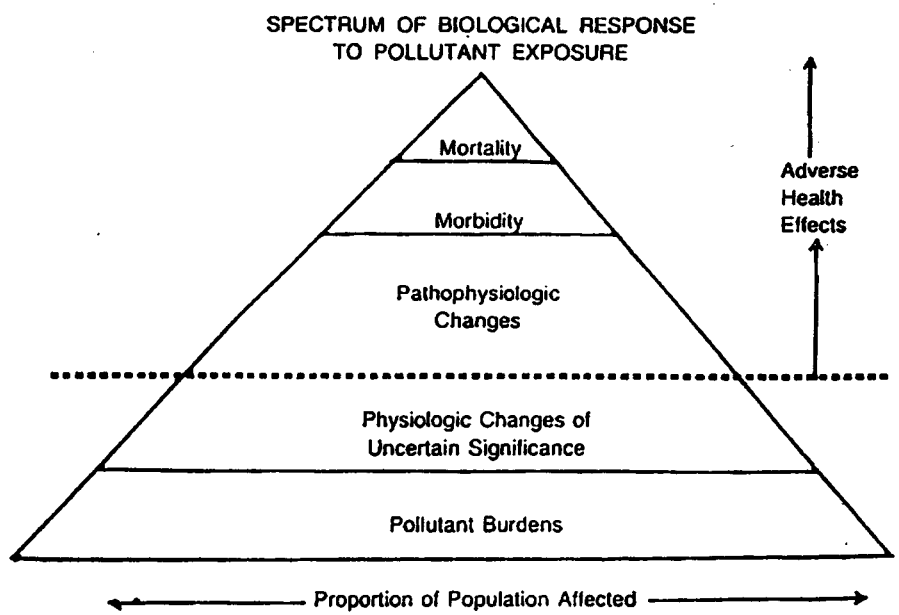

Fig. 1. Spectrum of biological response to pollutant exposure.

American Thoracic Society: Guidelines as to What Constitutes an Adverse Respiratory Health Effect, with Special Reference to Epidemiologic Studies of Air Pollution Am Rev Respir Dis 1985

PREPARED STATEMENT OF DR. CHRISTOPHER GRANDE, EXECUTIVE DIRECTOR, INTERNATIONAL TRAUMA ANESTHESIOLOGY AND CRITICAL CARE SOCIETY

Good morning. My name is Dr. Christopher Grande. I am a practicing physician from Baltimore, Maryland. I am a board-certified anesthesiologist and intensive care specialist in trauma injury. I have authored and edited numerous medical books and have had about 30 articles published in professional journals.

I am also Executive Director of the International Trauma Anesthesiology and Critical Care Society or "ITACCS" for short. ITACCS is a 10-year old professional association of more than 1,000 trauma specialists and emergency room physicians, nurses, and related professionals.

I also hold a masters degree in public health from the Johns Hopkins University School of Public Health.

I'd like to thank the committee and Chairman Inhofe for inviting me to provide ITACCS' views on the proposed ozone and particulate matter standards.

Before I specifically address the standards, though, I'd first like to give the committee some important background information.

Everyday I'm in the hospital emergency room , I see patients and problems vying for critical resources. From acute asthma patients to traumatic injuries. These are all competing public health priorities. All competing for limited available public health resources.

The focus of ITACCS is traumatic injury, often accidental in nature such as that caused by motor vehicle, on-the-job, or household accidents.

Injury is the leading caused of death for those under the age of 45.[1] And it is the fourth leading cause of death overall in the United States. About 150,000 deaths every year.[2]

Trauma cuts across all of society. The injured person is not someone else. The injured patient is you, your child, your spouse, your parent.

The average age of injury victims is 20. Death from injury is the leading cause of years-of-life-lost in the U.S.—more than twice the number of years of life lost as the next leading cause, cancer, and three times that of heart disease.

According to 1990 statistics from the Centers for Disease Control and Prevention, traumatic injury was responsible for approximately 3.7 million years of potential life lost.[3] In contrast, cancer was responsible for 1.8 million years of potential life lost. Heart disease was responsible for 1.3 million years of potential life lost.

What does this tell us? The National Academy of Sciences concluded in 1985 that trauma was the "No. 1" public health problem in the U.S.[4] This situation remains unchanged today. How is this relevant to the debate over the ozone and particulate matter standards?

It can be simply put in three words, "public health priorities."

The fact is that society has limited resources that it can spend on public health. As such, responsible public policy dictates that such resources be spent so as to achieve the "biggest bang for the buck."

ITACCS is not convinced, and neither should the public be, that the proposed ozone and particulate matter standards are a smart way to spend our limited resources.

But I want to make it clear that we are not singling out only the proposed ozone and particulate matter air quality standards. The proposed standards are merely the latest example in what we see as a disturbing trend of the last two decades where scarce public health resources are diverted from more clearly demonstrated beneficial uses.

The unintended consequence of this diversion might be a decrease in the overall effectiveness and efficiency of public health care delivery.

As the makers of our laws and the ultimate allocators of our public health resources, Congress should take the lead in rationally allocating our limited resources.

But how would Congress know what is a priority and what is not?

The process behind the proposed ozone and particulate matter air quality standards has not been helpful.

First, the proposed rules do not provide a ranking or comparison between the estimated health effects attributed to ozone and PM and those of other public health needs.

One of the health endpoints associated with the proposed rules is asthma. No doubt asthma is a serious issue and public health resources should be directed at asthma. But a recent study[5] published in the February 1997 American Journal of Respiratory and Critical Care Medicine a journal of the American Lung Association helps place air pollution-induced asthma in perspective.

In this study, which employs a study design that has been characterized[6] as the most reliable on the potential health effects of ambient ozone—i.e., the study model

of children attending asthma camp—air pollution was associated with a 40 percent increase in asthma exacerbation in children. It sounds bad, but what does this really mean?

Assuming for sake of argument that the authors' conclusion is reasonable, this increase in asthma exacerbation equates to one extra use of an inhaler among one in seven severe asthmatics on the worst pollution day. However, close scrutiny of this study reveals that many confounding risk factors for asthma exacerbation were not considered by the study authors. These risk factors include changes in temperature, atmospheric pressure, anxiety, physical exertion, allergens, dust, and fumes.

Moreover, this study is inconsistent with the general observation that while asthma has increased over the last 15 or so years, air pollution has decreased. There appears to be no generally accepted explanation for this phenomenon.

Therefore, this study does not satisfactorily link ambient ozone with asthma exacerbation.

Before we commit our scarce resources wouldn't it be useful to know exactly where this very uncertain health effect ranks among other *real* public health priorities?

If asthma qualifies as a public health concern, appropriate levels of funding should be targeted at programs that have been proven to be effective, but not fully implemented. Such programs include appropriate research, public and patient education, increased compliance with asthma medication schedules, intelligent avoidance of triggering factors, etc.

Just last week, President Clinton issued an Executive order requiring Federal agencies to pay more attention to environmental health and safety risks that disproportionately affect children. While it is easy to agree with the intent of the Executive order, it is not clear that air pollution disproportionately affects children. What is clear is that traumatic injury disproportionately affects children, and it has been clearly identified as the leading cause of death in children.[7]

Second, the proposed rules do not provide an accurate estimate of what their associated opportunity costs are.

For example, if a community is forced to spend its resources implementing the ozone and particulate matter air quality standards, what other public health needs will the community sacrifice? A new trauma center? Training for its paramedics? A new ambulance?

Filling these other public health needs can produce results that cut across many public health problems. For example, ambulances and trauma centers benefit everyone from asthmatics to heart attack and trauma victims.

It would seem to be good public policy to develop and rely on an analysis of opportunity costs.

Third, the true uncertainties associated with the proposed ozone and particulate matter air quality standards have not been fully presented.

For example, it has been estimated and widely reported that chronic exposure to fine particulate matter causes 20,000 deaths per year. In fact this estimate appears to be based on very uncertain epidemiology.

It was acknowledged recently by EPA[8] and reported in major newspapers such as The Washington Post[9] that the simple error of using an arithmetic "mean" instead of an arithmetic "median" reduced the estimated mortality from fine particulate matter by 5,000 deaths.

It could very well be that chronic exposure to fine particulate matter, in fact, causes no deaths. On this point, it is greatly troubling that the data underlying this estimate has yet to be made publicly available.[10] Given that major confounding factors for mortality appear to be omitted from the analyses—factors like lack of exercise, poor diet, and prior health history—weak epidemiologic associations could easily vanish with more thorough analysis.[11]

In stark contrast to what has been hypothesized about particulate matter and mortality, we know that about 150,000 people die every year from injury. These are *real* deaths, not those calculated through debatable assumptions and statistics.

One year ago the television show Dateline NBC featured the story of Robert Meier.[12] In April 1995, Mr. Meier was driving through rural Oklahoma heading home for Easter. Just before 4 o'clock that Saturday afternoon, Meier's van careened off the highway, slamming through a guardrail. His van rolled over five times before plummeting into a ravine. Within a few minutes rescue personnel were at the scene.

The ambulance took Mr. Meier to Shawnee Regional Hospital. But the doctor on duty determined that Mr. Meier had serious internal injuries and needed to be transferred to another hospital better equipped to treat them. But as Mr. Meier bled profusely from a ruptured aorta, no hospital in the area would accept him because critical resources were not available.

It was not until half past midnight, 8 hours after his accident, that a surgeon was found to operate on Mr. Meier. This delay cost Mr. Meier his life.

Mr. Meier was fully covered by health insurance. He had done his part. But because of a lack of crucial resources, the system failed.

Stories like this one are common. But they should not be, nor do they have to be. Proven solutions are possible now, but must compete for attention and funding.

More than 25 studies indicate that between 20,000 and 25,000 Americans who die each year from injury could be saved if regional trauma systems were in place across the Nation ensuring prompt access to a qualified trauma center.

In 1973, Congress enacted the Emergency Medical Services System Act to help States improve their trauma systems. But lack of Federal support made this an unfunded mandate that States could not afford to implement on their own. And as a result, significant deficiencies exist in trauma systems across the country like the one that resulted in Mr. Meier's death.

But how would Congress know this when currently there is no mechanism to identify, compare, and prioritize public health needs. The ozone and particulate matter proposals in their present formats are prime examples of this defect in how we do public health in America.

I understand that a bill was introduced in the last Congress which would have required the comparative ranking of health risks. This would be helpful for prioritizing our public health needs. I urge that Congress continue along this track.

Stimulated by this latest raid on our scarce public health resources, ITACCS is establishing a new forum to facilitate public debate on the allocation of public health resources. The mission of the National Forum for Public Health Priorities will be to provide policymakers with information necessary to prioritize public health needs.

Those who wish to commit the public's limited resources should be required to justify such proposed commitments against all other competing needs. And, as a major allocator of public health resources, Congress must ensure that the public health is not short-changed by unproductive expenditures.

Thank you for your attention. I will be happy to answer any questions you may have.

NOTES

1. *Journal of the American Medical Association.* 1994;27:495.
2. National Safety Council. 1993. *Accident Facts.*
3. Centers for Disease Control and Prevention: Years of potential life lost before ages 65 and 85—United States, 1989–1990. *MMWR* 41:313, 1992.
4. National Research Council. 1985. *Injury in America: A Continuing Public Health Problem.*
5. *Am J Crit Care Med* 1997;155:654–660.
6. *See* EPA Criteria Document for Ozone.
7. National Safety Council, *Accident Facts* (1996 ed.).
8. EPA Press Release, April 2, 1997.
9. *The Washington Post* (April 3, 1997).
10. *The Wall Street Journal* (April 7, 1997).
11. *See, e.g., American Journal of Respiratory and Critical Care* 1995; 151:669–674 (the "Pope" study).
12. *Dateline NBC* (March 17, 1996).

PREPARED STATEMENT OF HARRY C. ALFORD, PRESIDENT AND CEO, NATIONAL BLACK CHAMBER OF COMMERCE

My name is Harry C. Alford, President and CEO, National Black Chamber of Commerce. The NBCC is made up of 155 affiliated chapters located in 43 States. We have three (3) divisions—Eastern, Central, Western; nine (9) regions and 43 district offices. Through direct membership and via our affiliated chapters, the NBCC directly speaks on behalf of 60,000 Black-owned businesses and represents the total populace of Black-owned firms which, according to the U.S. Census Bureau of Statistics, is over 620,000.

The NBCC is opposed to the two proposals presented by the EPA that would set a more stringent ozone standard and establish a new PM (particulate matter) standard for emissions at or below 2.5. The Clean Air Act of 1990 has made much progress in improving our environment. We sincerely feel that the continuance of this process will further improve the environment. To put more stringent demands on our businesses will have an extreme adverse impact on business in general with

even higher stakes to lose for small businesses per se. If big business gets a "cold", small business gets the "flu" and Black-owned business suffers "pneumonia".

An example of the above can be found in our campaign to develop business partnerships with the automobile industry. We have approached and are working with principals within the management of Ford, Chrysler and General Motors. One success story is that at the time of preliminary discussions with Chrysler, we had no Black-owned architect, civil engineer or construction company performing work of over $1 million. Today, after just 1 year of interaction we have businesses in such disciplines actively working on or negotiating over $100 million worth of Chrysler expansion.

That is just one example, these three auto makers have expansion plans set for the cities of Arlington, TX, Oklahoma City, Kansas City, Fairfax, MO, Shreveport, LA, Janesville and Kenosha, WI, Belvedere and Chicago, IL, St. Louis, Ft. Wayne, Kokomo and Indianapolis, IN, Flint, Lansing and Detroit, MI, Toledo, Twinsburg, Lima, Dayton, Cincinnati, Cleveland and Warren, OH, Louisville and Bowling Green, KY, Springhill, TN, Athens, MS, Atlanta, Eastern, NY, Linden and Edison, NJ, Wilmington and Newark, DE, Baltimore, and Norfolk, VA. This is an expansion investment of $37.9 billion which is the equivalent of total sales for all Black-owned businesses combined! Just competing for this business and winning 10 percent would increase the total national output of America's Black-owned businesses by over 10 percent.

It's a goal worth going after. However, it may not exist for the Black segment of this economy if the new standards go into effect. This is just the auto industry. We are busy creating alliances with the oil industry, electrical utilities, telecommunication companies, etc. The potential for economic parity and true capitalism in Black communities—THE MISSING LINK—is before us! Viable employment through an economic infrastructure in currently distressed neighborhoods is going to be the answer to improved health care, education, family values and the decrease in hopelessness, crime, welfare and violence. There just is no other way to do it.

We have heard coming out of EPA terms such as Environmental Justice and Environmental Racism. Such terms are not accurate in their description. They imply that the "evils of big business" conspire in back rooms to wreak havoc on minority communities via dumping of toxic/hazardous materials, etc. The coincidence of environmental hazards in minority communities is a matter of economics. Property values and shifts in desirable business properties are the main reasons. Minority populations just happen to live (after a cycle of geographical shifts) in these communities.

However, if there was ever a policy or a proposed regulation that could be considered directly adversarial to a particular segment of our population we may now have it. The proposed standards are going to hit urban communities the hardest. Of the 620,000 Black-owned businesses at least 98 percent of them are located in urban areas (U.S. Census). Hispanic and Asian businesses probably can claim the same. As mentioned above, Black-owned businesses are presently at the end of the business "food chain". If business suffers, Black businesses will suffer the most. The main vehicle for Black community development is business startup and growth. The proposed standards will become predatory to Black-owned businesses and all Black communities and we must vehemently protest them.

The NBCC has been quite successful since its conception in 1993. We have Black church organizations, educators, political leaders and traditional civil rights organizations talking about economics—the lack thereof—like never before. Corporate America has been waiting on Black communities to focus on the principles of capitalism which is the bloodline for our future and security. The time is before us and I foresee a rapid change in economic empowerment for communities that have suffered for too long. The EPA's attitude and it's proposals are counter to this trend and, thus, pose the biggest threat. The increased costs that will pain the Fortune 500 and maim small businesses will obliterate minority businesses, especially Black owned businesses. The end result is lost jobs and lack of capital infusion.

I personally lived in Detroit and Chicago during economic downturns. What was experienced by dwellers of these urban communities and others was not a pretty sight at all. Shame on us if we allow this to happen once again because we quickly move to make the Earth "pristine" in a fashion that will surely hurt our economic infrastructure.

Let us work in harmony toward making the environment as safe as possible without making those who have the least resources pay the most. The National Black Chamber of Commerce pleads with Congress to strongly consider the ills of the proposed standards and encourage EPA to be more thoughtful and universal in its approach.

PREPARED STATEMENT OF FRANK HERHOLD, EXECUTIVE DIRECTOR, MARINE INDUSTRIES ASSOCIATION OF SOUTH FLORIDA

Mr. Chairman and subcommittee members, good afternoon my name is Frank Herhold. I am the Executive Director for the Marine Industries Association of South Florida, which represents over 640 marine businesses. I am also here today on behalf of the National Marine Manufacturers Association (NMMA), which is the national trade association representing over 1500 boat builders, marine engine and marine accessory manufacturers.

I am here today to explain why the EPA's proposed revision to the National Ambient Air Quality Standards (NAAQS) will be bad for recreational boating. What is bad for recreational boating is bad for the State of Florida and the Nation. There are currently 750,000 registered boats in the State of Florida and the latest annual marine retail sales figures topped $11 billion in Florida. To put this into perspective, in Broward County alone, the marine industry represents a total economic output of $4.3 billion employing 88,390 people, with an average growth rate of 6.5 percent. Boating brings dollars and jobs to the State of Florida.

The Clean Air Act Amendments of 1990 have placed a significant technical and economic challenge on the recreational boating industry. The new marine engine emission regulation which was finalized in July 1996 will require that all new marine engines reduce hydrocarbon emissions by 75 percent. Economic impact estimates have this regulation costing the industry over $350 million, increasing the cost per boat engine by as much as 15 percent. The Clean Air Act will also regulate air emissions from boat manufacturing plants with a MACT (Maximum Achievable Control Technology) standard scheduled to be promulgated in the year 2000. This regulation will also be costly raising the price of boats, thus directly reducing the number of people who can afford to enjoy boating.

Needless to say, the proposed revised NAAQS will have a devastating effect on the recreational marine industry. Without drastically reengineering American society, States will be forced to press emission sources for further reductions, many of which like the recreational boating industry, have reached the point of diminishing returns.

Several years ago, when the NAAQS for ozone was initially set at .12 ppm, some State regulators in non-attainment areas considered bans on recreational boating as a method to meet the requirements of their State Implementation Plans. The Washington DC Council of Governments (COG) actually proposed a ban on recreational boating in 1993. This proposal raised immediate opposition from boaters, marinas, waterfront restaurants, and other effected groups. COG eventually reversed its decision after the affected parties spent considerable resources to educate COG as to the proposal's adverse effects. This EPA proposed revised standard will again force States to reconsider episodic bans and this time States may be pushed to implement episodic restrictions on recreational boating throughout the Nation.

I am appealing to you to stop EPA's attempts to revise the standards at this time. It is my understanding that the scientific studies that EPA is using to defend this proposal do not take into account either the specific constituents in air pollution or other mitigating factors that effect human health. I feel that EPA would be premature to impose such a burdensome standard without first identifying the specific benefit and real cost of the proposal. Even if we fail to convince EPA that it is making a terrible mistake, at a minimum, let's somehow prevent States from using episodic bans as a means to attain compliance. Episodic bans will negatively effect a person's decision to purchase a boat, knowing that on the hottest days of the summer the government can take away his or her freedom to operate it. Not since Congress passed the luxury tax have boaters faced a more serious threat. If this standard is finalized in its current proposed form, consider the burden it will place on States, industry and its workers, and the million of people who just want to spend a summer afternoon on the water with their family.

In conclusion, everyone needs to realize that America's air is cleaner and will continue to improve, as the benefits from recently and soon to be initiated Clean Air Act regulations are realized. What we do not need now is more regulation. What we need now is the time and resources to implement those regulations that are already on the books. Boaters want clean air and clean water and the recreational marine industry is ready to assist both Congress and the EPA in this rulemaking process. Thank you for the opportunity to testify.

PREPARED STATEMENT OF JEFFREY SMITH, EXECUTIVE DIRECTOR, INSTITUTE OF CLEAN AIR COMPANIES, INC.

Good afternoon. My name is Jeffrey C. Smith and I am the Executive Director of the Institute of Clean Air Companies, Inc. ("the Institute" or "ICAC"). The Institute is pleased to participate in today's hearing, and applauds the Subcommittee for providing this opportunity to share different ideas and views on the important matter of EPA's proposed revisions to the particulate matter and ozone ambient standards (NAAQS).

By way of introduction, ICAC is the national association of companies that supply air pollution control and monitoring technology for emissions of air pollutants, including emissions of sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and particulate matter (PM), which contribute either directly or as precursors to fine particulate matter and ozone in the atmosphere. ICAC businesses compete with each other, offer the full spectrum of technologies available, and serve all stationary source emitters that would be affected by the revised standards.

This afternoon I will briefly address, qualitatively, the impact of the proposed standards on the U.S. air pollution control technology industry and the overall cost of the proposal.

The U.S. air pollution control industry supports EPA' proposal to revise the ozone and particulate matter ambient standards. Suppliers of control technology for the pollutants that would be affected by the EPA proposal employ tens of thousands of people, and these firms in general have suffered disappointing earnings which have necessitated severe downsizing in many cases. The EPA proposal would benefit these businesses at an important time.

I should note also that nearly all suppliers of technology to control the emissions that are precursors of ozone and fine particulate matter are small businesses. Indeed, for the control of volatile organic compounds, a leading precursor of ozone, I estimate that over 95 percent of the 100+ control suppliers are "small businesses", i.e., have fewer than 500 employees. In the great majority of cases, these companies have far fewer than 500 employees.

Thus, resolving the admittedly tough clean air issues we face in a way that protects public health and the environment has an important side-benefit: it would also promote the air pollution control industry, which creates jobs as compliance dollars are recycled in the economy. This industry is currently generating a modest trade surplus to help offset the billions this Nation hemorrhages each month on international trade, and is providing technological leadership that can continue to be deployed in the fast-growing overseas markets for U.S. air pollution control technology.

With regard to the overall cost of the EPA proposal, I note first the Institute's support for the two-step process of setting ambient air quality standards, and then addressing implementation and cost issues. This process has received bipartisan support and worked well for over two decades. By clearly separating health science and cost/implementation issues, the process actually allows the public, as well as Federal and State government authorities to rationally parse out an then balance all policy issues. In short, no emitting source will have to comply with the new standards before costs are thoroughly examined.

No one of course knows what the exact cost of the proposal will be. To be sure, there will be an implementation cost, but it is well to remember several important lessons of the past 27 years in implementing the Clean Air Act.

One of these is illustrated by my experience nearly a decade ago when I sat before various House and Senate Committees and presented detailed implementation cost estimates for the acid rain provisions of what became the Clean Air Act Amendments of 1990. Regulated industry claimed the removal costs of SO_2, the leading precursor to acid rain as well as a precursor to fine particulate matter, would reach thousands of dollars a ton, while EPA claimed a more modest sum of $1,500 to $2,000 a ton was about what we could expect. I disagreed, arguing that market and technical data supported a dollar-per-ton-removed cost of about $500. But I overestimated the cost, too, since today, in 1997's inflated dollars, a ton of SO_2 is removed for only $110 a ton.

The preeminent lesson of our Nation's 27-year history under the Clean Air Act is that actual compliance costs turn out to be much lower than the costs predicted at the outset of a regulatory action because the regulated community, markets, and control technology suppliers are smarter and more efficient at reducing costs than forecasters predict. This is even more true in light of today's emphasis on flexibility in compliance and authorized use of and credit for market-based approaches and pollution prevention.

Those who predict gargantuan cost impacts ignore this important lesson, and also underestimate the wisdom of State and local officials who will be implementing these standards. Everyone has an interest in rational and prudent clean air policy, and the cost effectiveness of various compliance options will be considered during implementation. And there is no reason not to believe that, as has always been the case, all of us—regulated industry, government officials, and technology suppliers—will discover ever more cost-effective compliance solutions, especially since nearly a decade exists between now and when the impact of new standards would be felt.

For our part, members of the Institute continue to invest in research and development to improve removal efficiencies while lowering costs and simplifying operation. We have to. The air pollution control technology industry is innovative and highly competitive. And improvements in cost-effectiveness are what give one business or technology a competitive advantage over another.

It is no exaggeration to say that the clean air policy choices we make in 1997 will determine the amount of air pollution that affects the health and environment of ourselves and our children over the next decade and beyond. Ten years is a long time, nearly a life-time for childhood. We must, therefore, choose correctly, informed both by lessons learned from our nearly three decades of Clean Air Act experience, and by a vision for the future which reflects, as does every opinion poll, the American public's demand for a clean and healthy environment.

In closing, the Institute again expresses its appreciation to the Subcommittee for providing a forum for dialog on this important issue. In our view, EPA has taken the proper course by its efforts to establish ozone and particulate matter standards that protect public health. If those health-based standards are revised, the U.S. air pollution control industry is ready to do its part to help our Nation achieve its clean air goals cost-effectively. Based on historical precedent, the current pace of control technology innovation, the use of market-based incentives, the years between now and compliance deadlines, and competition within the air pollution control technology industry and among technologies, we are confident that the actual cost of compliance will be less than most of us today imagine.

PREPARED STATEMENT OF GLENN HEILMAN, VICE PRESIDENT, HEILMAN PAVEMENT SPECIALTIES, INC.

Good Morning. My name is Glenn Heilman. I am the Vice President of Heilman Pavement Specialties, Inc., a small family owned business that has been in operation for 41 years. We are located in Freeport, Pennsylvania which is just above Pittsburgh. Thank you for giving me the opportunity to testify on behalf of the National Federation of Independent Business regarding the recently proposed national air quality standards for ozone and particulate matter.

NFIB is the nation's largest small business advocacy group representing 600,000 small businesses in all fifty States. NFIB's membership reflects the general business profile by having the same representation of retail, service, manufacturing and construction businesses that make up the nation's business community.

In addition to being a small business owner, I also volunteer and serve as Chairman of Pennsylvania's Small Business Compliance Advisory Panel. This panel is mandated by Section 507 of the Clean Air Act Amendments to help small business as part of the Small Business Stationary Technical and Environmental Compliance Assistance Program. This program has been enormously successful despite underfunding and has become a model for small business programs in other environmental legislation.

Our small business program conducts seminars, offers a toll-free confidential hotline, low interest loans and many other outreach efforts for small businesses. Every State has such a program in varying degrees of effectiveness. These programs are valuable tools to improve our air quality and are overseen by the Environmental Protection Agency.

In my position as Chairman, I am keenly aware of the progress we are making in cleaning our air. What appears to be ignored is that air quality has improved significantly since passage of the Clean Air Act, and the 1990 amendments have not even been fully implemented. It is therefore imperative that only requirements that are essential be mandated. What I suggest is that we move toward more complete compliance with existing standards before revising them.

As a small business owner, the economic impact and burdensome regulations of the proposed standards would significantly affect and threaten the livelihood of my business. As a manufacturer of road pavement, my business operates asphalt plants and hauls stone as a raw material. The moving of equipment and materials creates minor particulate matter. I also have air emissions from my heavy truck and off-

road equipment. Some of this equipment is old, but works well. I simply cannot afford to buy new equipment to comply with the proposed regulations.

As a small business owner, I am active and involved because I have to be. Careless regulations will put me out of business. Not only will small business owners lose life savings and investment, but our employees lose their jobs and our communities will suffer economically. For that reason, I am shocked and disappointed that the EPA has declined to consider the effects of this proposed rule on small business.

Last year, Congress passed and the President signed a law that requires the EPA to assess the impact of regulations on small business. To date, the EPA has refused to do this on the ozone and particulate matter standard. Because this regulation is likely to have a great impact on a variety of small businesses, I hope that the EPA will carefully consider the consequences before they impose this new standard.

Rather than implementing new regulations for clean air, I recommend utilizing and encouraging the use of present means to achieve air quality improvements. There are technologies presently available to help clean our air. In our company we voluntarily look for ways to improve the environment. In 1980 my father developed a new, ozone-friendly technology for asphalt roads. This technology is exemplified in a material called HEI-WAY General Purpose Material or HGP. A 2-year university study documents that HGP emits seven times less Volatile Organic Compounds (VOC)—in the form of low molecular weight normal and branched alkane hydrocarbons—than the present technology used to pave roads. Additionally, this technology also eliminates a significant water pollution threat to rural streams and wetlands.

Under standard technology, present road paving methods allow more than 1000 gallons (or three tons) of gasoline-type VOC to evaporate into our troposphere for every mile paved. HGP reduces this VOC air pollution by 85 percent. On a nationwide basis, of the nearly 4 million miles of roads in the country, this technology is applicable to over 60 percent of them. In Pennsylvania alone, if just 1 percent of the roads were paved each year with HGP instead of the standard technology, over 3000 tons of VOC air pollution would be eliminated. The HGP technology could be more widely used to lower VOC air emissions as soon as EPA allows for Discrete Emissions Reduction Credits (DER) under the New Source Review.

In closing, it is important to keep in mind the unique nature of a small business owner when examining our reaction to environmental legislation and regulations. Small business owners wear many hats. Two of the most important are being both a business owner and a citizen of a community. We drink the water, breathe the air, and fish in the lakes. We want a healthy environment for ourselves and our children. However, we also expect the government to be fair and responsible.

New regulations as proposed by EPA for ozone and particulate matter are unnecessary, will result in an enormous regulatory burden and threaten a business that my family has spent 41 years to build. A viable framework is in place. It consists of new, environmentally friendly technologies, such as HGP, and couples these initiatives with existing programs. The system is working. Let's use what we have.

STATEMENT OF ASSOCIATED BUILDERS AND CONTRACTORS

Associated Builders and Contractors (ABC) thanks the Senate Clean Air, Wetlands, Private Property and Nuclear Safety Subcommittee for the opportunity to submit a statement on the Environmental Protection Agency's (EPA) proposed rules on ozone and particulate matter in the atmosphere. ABC believes that the EPA is proposing new Federal air quality regulations for ozone smog and fine particles that could have crippling effects on hundreds of thousands of American construction workers and cost consumers and businesses billions of dollars, with little or no health benefit.

ABC is a national trade association representing over 19,000 contractors, subcontractors, material suppliers, and related firms from across the country and from all specialties in the construction industry. ABC's diverse membership is bound by a shared commitment to the merit shop philosophy of awarding construction contracts to the lowest responsible bidder through open and competitive bidding. This practice assures taxpayers and consumers the most value for their construction dollar. With 80 percent of the construction performed today by open shop contractors, ABC is proud to be their voice.

After careful review of the technical and health information and analyses in the Criteria Document and the Staff Paper prepared by EPA for this rulemaking, the Clean Air Scientific Advisory Committee (CASAC), the agency's expert review panel established by the Clean Air Act and appointed by the Administrator, concluded there were significant uncertainties and unanswered questions that had to be ad-

dressed before EPA proceeds with the Particulate Matter (PM) rulemaking. Additionally, the same panel concluded there was no health basis to establish new National Ambient Air Quality Standards (NAAQS) for ozone. ABC concurs with CASAC's opinion and strongly advises EPA to reaffirm the current standards for PM and ozone while initiating a targeted research program to resolve the questions and uncertainties identified during the just-completed review process.

The proposed tightening of the ozone and PM NAAQS, in conjunction with the highway funding sanction authorities and Metropolitan Planning Organizations (MPOs) approval requirements of the Clean Air Act Amendments (CAAA) and 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), pose enormous restrictions to the transportation construction industry throughout the United States. The combination of these new regulatory requirements endanger tens of thousands of jobs and create major new constraints to mobility.

Additionally, ABC is concerned that the EPA has not adequately taken into account the affect these costly new requirements will undoubtedly have on the American worker and average motorists. If the EPA succeeds in changing the standard such limitations as mandatory employee carpooling, centralized state-run emissions inspections, and the use of more expensive reformulated gasoline are only a few of the policies that will adversely affect small business. Other transit initiatives could be higher vehicle taxes and higher tolls in peak driving times.

Non-vehicle remedies could place restrictions on the use of power tools, lawn mowers, and snow blowers as well as other equipment. ABC shares with all Americans an interest in efforts to preserve, protect and enhance the natural environment. Pollution prevention is in our nation's interest; however, efforts to reduce emissions must be balanced with considerations for the safety of those operating the equipment, as well as the cost and technological feasibility of achieving any prescribed reductions. Many construction industry workers rely upon non-road engines in their daily efforts to safely build construction projects on time and on budget. The performance and reliability of these engines directly impact a contractor's ability to successfully execute their contracted responsibilities on the construction job site.

The EPA initially claimed the new PM/ozone standard will extend the lives of as many as 20,000 people a year (recently revised down to 15,000 people). Clearly, the extent of this health risk is of concern. However, exactly which components in urban air are causing the health problems is not yet well understood. The EPA's preference for regulating every fine particle in the air before understanding the real causes and quantifiable health benefits is not a prudent strategy. ABC is concerned that:

(1) The EPA has failed to properly characterize PM concentrations across the United States. Key technical analyses have not been completed. For example, the EPA has not determined the chemical composition or size of the particulate matter that is linked to the supposed increases in mortality and morbidity. The EPA has also failed to identify the biological mechanism that would explain the link between $PM_{2.5}$ and increases in mortality. The use of a nationwide $PM_{2.5}/PM_{10}$ ratio to estimate $PM_{2.5}$ concentrations is insupportable from the limited $PM_{2.5}$ data available.

(2) The EPA has failed to accurately analyze the impact of the new standard. The EPA has stated its refusal to conduct a small business analysis for these rules. The Regulatory Impact Analyses (RIAs) are incomplete; no analysis was conducted on the proposed secondary ozone standard, no analysis was conducted on impacts to small businesses, the unfunded mandates act was not addressed, and the analyses do not estimate the full cost of attaining the proposed standards throughout the country (there are "residual nonattainment areas"). The RIA for ozone rulemaking does not use the proposed standards in the Notice of Proposed Rulemaking as the basis for its costs and benefits projections.

(3) The EPA has used questionable health impact studies to justify their actions. There is virtually no $PM_{2.5}$ exposure data on either the general population or on susceptible populations. The use of community-based epidemiological studies are not appropriate because individual personal exposures do not correspond to these community-based studies.

Due to the predominance of small businesses within the construction industry. ABC remains concerned that compliance with the Clean Air Act Amendments could have significant adverse effects. We continue to encourage the Congress to give serious consideration to the impact these new requirements would have on small businesses.

Associated Builders and Contractors strongly urges that there be no change in the ozone or particulate matter standards at this time until more comprehensive scientific studies can be performed. Again, ABC appreciates this opportunity to submit a statement for the record.

Docket # A-95-58
A-95-54

TESTIMONY OF JOHN CAHILL
ACTING COMMISSIONER
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

REGARDING THE PROPOSED AMENDMENTS TO
THE NATIONAL AMBIENT AIR QUALITY STANDARDS FOR
OZONE AND PARTICULATE MATTER

JANUARY 15, 1997

Good Morning. My name is John Cahill, and I am Acting Commissioner of the New York State Department of Environmental Conservation. I appreciate this opportunity to present New York's perspective on the proposed amendments to the National Ambient Air Quality Standards for ozone and particulate matter.

As you are aware, Section 7409 of the federal Clean Air Act requires that the U.S. Environmental Protection Agency establish National Ambient Air Quality Standards for criteria pollutants which "are requisite to protect the public health," and review these standards on five-year intervals. Based on such a review, EPA has now proposed revisions to the standards for both ozone and particulate matter. While we are encouraged with the efforts of EPA to meet these requirements of the Clean Air Act, and support efforts to ensure that the air quality standards are protective of the public health, we have several comments to make regarding EPA's proposed revisions.

In its 1991 report "Rethinking the Ozone Problem in Urban and Regional Air Pollution," the National Research Council identified several shortcomings in EPA's existing strategy to reduce concentrations of tropospheric ozone. In its report, which was mandated by the Clean Air Act, the Council suggested that the existing monitoring tends to measure transient "spikes" in ozone concentrations rather than baseline or average levels, and is overly sensitive to weather fluctuations. Both of the problems, the report concluded, could be traced to the fact that the existing ozone standard looked at concentrations on a peak one-hour basis. We are therefore supportive of EPA's proposal to amend the ozone standard to an eight-hour interval.

Over the years, New York has had some success in meeting the existing ozone standard of 0.12 parts per million. Most of upstate New York, which had been in non-attainment with the standard, has recently experienced several years of "clean data." Even the New York City metropolitan area has shown a marked reductions in ozone levels. The region exceeded the standard only two times during the 1996 ozone season, compared to 38 times in 1980. While we will support any standard that is based on strong scientific evidence, we are concerned about the impact a revision to the ozone standard will have on New York's efforts to meet federal air quality goals, especially without dramatic improvements in the quality of air entering the state.

For instance a revision of the standard to 0.07 ppm, the more stringent scenario in the EPA proposal, could cause most of the upstate region to be once again designated as non-attainment. There is evidence that baseline levels of ozone could reach as high as 0.06 ppm, therefore making a standard of 0.07 ppm virtually impossible to attain. As previously stated, we support setting the standard at a level which is protective of the public health, but setting it so low that it could conceivably never be attained, even under the best of circumstances, would benefit no one. Literally billions of dollars would be spent chasing an unattainable goal.

It is difficult to ascertain just how the upstate region of New York would fare if the standard were set at a level of 0.08 ppm. Available data from the last three years indicate that much of upstate New York is currently hovering around the 0.08 level. This makes it vital that EPA use real-world monitoring data for the coming years, rather than modeled predictions based on previous data, when making its attainment designations. EPA should also require affected states to install monitoring networks with sufficient density to provide robust data and high confidence in the designations it does make. In this manner, improvements made in the upstate region in the next three years will be included when making an attainment determination. We further support EPA's proposal to require measurements to be taken to two decimal points (0.08) rather than three (0.080).

Another concern relating to the proposed amendments involves modifications to the existing designation levels that would be needed as a result. Currently, the five levels of ozone non-attainment, ranging from marginal to extreme, and the associated control strategies are set forth in the Clean Air Act. Any changes made to the existing standard will require corresponding modifications to these designations as well and, therefore, the control strategies a given area would have to implement. It is our understanding that these amendments would be made by EPA in a rulemaking. We therefore feel it is vital that there be sufficient opportunity for the states and other interested parties to participate in drafting such regulations, and to review and comment on any future changes to the non-attainment designations before they are implemented.

While there may be some uncertainty regarding how the proposed amendments to the ozone standards will affect upstate New York, it is likely that certain segments of the Midwest would be reclassified as non-attainment if the new standards are implemented. New York State has repeatedly expressed concern that it will never be able to meet even the existing ozone standard so long as the air entering the state at its western and southern boundaries already exceeds that standard. As a member of the Ozone Transport Commission, New York has enacted several control measures beyond those required by the federal Clean Air Act in an effort to attain the ozone standard. We have also actively participated in the Ozone Transport Assessment Group, consisting of the 37 states east of the Rocky Mountains, in hopes of achieving significant reductions in the long-range transport of ozone and its precursors. Regardless of the final outcome of the proposed amendments to the ozone and particulate matter standards, it is crucial to New York's attainment strategy that the large sources of ozone precursors located in the Midwest and Southeast be required to install the same level of controls currently required in the Northeast. In this manner, the air quality of the entire region will improve, and the Northeast will be able to compete on equal footing with the Midwest as the electric generation industry is deregulated. We further support EPA's position that the negotiations and rulemakings regarding long-range transport of ozone precursors now underway should not be postponed as the revisions to the air quality standards are considered.

As with the ozone standard, we are concerned about the environmental and public health impacts of long-range transport of fine particulates. In a recent report, the American Lung Association estimated that inhalation of particulates is responsible for some 60,000 premature deaths in America every year. Epidemiological evidence suggests that fine particulates pose an immediate risk to the health and well being of our citizens. The same contaminants that are largely responsible for fine particulates are also significant contributors to both ozone formation and the acidic deposition that continues to plague the forests and water bodies of the Northeast. Reductions in emissions in the OTAG region that lead to these particulates will therefore pay off fourfold, resulting in decreases in acidic deposition and ozone as well as the direct reductions in particulate matter, which in turn will help improve visibility throughout the region.

As with the proposed changes to the ozone standard, it is important that EPA base any redesignation for the particulate matter standards on observed, real-world data rather than on computer modeling. EPA will also soon need to propose and finalize specifications for the equipment used to monitor fine particulates. From our recent experience in designing and installing monitors in New York City, it is clear that there will be considerable additional expense associated with the monitoring network needed to determine compliance with the new standards. As federal funding for compliance with the requirements of the Clean Air Act continues to dwindle, EPA must be cognizant of the substantial increase in resources that will be needed to meet the monitoring requirements of both the ozone and particulate standards.

In conclusion, New York fully supports the efforts of EPA to set new standards for ozone and particulates, provided that they have a scientific basis and are attainable. We feel that an eight-hour ozone standard is preferable to a current one-hour standard, both to reduce the impact of weather fluctuations, and to provide an accurate assessment of the true effectiveness of control strategies by measuring average ozone levels rather than worst case, transient events. We also feel that EPA and Congress should be cognizant of the costs these new standards will impose on the states when considering funding levels for grants under Section 105 of the Act. The Department will be submitting more detailed comments before the close of the public comment period. Thank you again for providing me with this opportunity to present our viewpoints on this matter.

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-

John P. Cahill
Acting Commissioner

U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center (6102)
Attn: Docket Number A-95-38 Interim Implementation Policy
401 M Street, SW
Washington, D.C. 20460

Dear EPA Docket Representative:

The New York State Department of Environmental Conservation (NYSDEC) appreciates this opportunity to comment on the United States Environmental Protection Agency's (EPA's) notice of proposed policy on the interim implementation of the new and revised ozone and particulate matter (PM) National Ambient Air Quality Standards (NAAQS), as contained in the December 13, 1996 Federal Register (61 FR 65752). We commend the EPA for its efforts to meet the requirements of the Clean Air Act and develop air quality standards which protect the public health. While we support EPA's efforts to develop a policy that will ensure a smooth transition to the new or revised ozone and PM air quality standards, NYSDEC offers the following comments to help improve this proposed policy.

Basis for the Interim Implementation Policy

NYSDEC is encouraged by the efforts of EPA to base its interim implementation policy (IIP) on principles of no backsliding and continued progress. As the transition to the new and revised ozone and PM standards moves forward, it is critical that we preserve improvements in air quality to date and that we continue to make progress towards cleaner air. It is, therefore, important that EPA expedite, through final rulemaking, the provisions of the IIP to ensure the needed health and welfare benefits.

To uphold the no-backsliding principle, EPA is proposing that the effective date of the revocation of the existing ozone NAAQS be deferred until EPA approves a state implementation plan (SIP) revision that provides for an area to achieve the new NAAQS. Two exceptions to this deferral are allowed, however. The first exception pertains to the requirement to demonstrate attainment of the existing NAAQS by the attainment dates set forth by the Clean Air Act. NYSDEC agrees with this aspect of EPA's proposal since it is appropriate for areas to shift their development of attainment demonstrations based upon the new NAAQS. The second exception relates to the reclassification of areas upon a failure to attain the current ozone standard by the applicable statutory attainment dates. The proposed IIP would relieve such areas from complying with certain additional control measures that they would have been subject to had

they been reclassified in accordance with the provisions of subpart 2 of part D of the Clean Air Act. Qualifying extensions should continue to be allowed once the EPA validates the ozone air quality data from the year preceding the extension year. NYSDEC believes that areas granted such extensions of the attainment date should continue to meet rate-of-progress (ROP) requirements until EPA approves the new SIPs, unless an area attains the existing ozone standard by 1999, at which time, such area should continue to offset emissions growth and ensure maintenance of air quality. Any area with obvious continuing air quality problems should be prompted to assume interim designation as a nonattainment area.

Transport Issues

New York State has repeatedly expressed concern that we will not be able to attain the existing ozone NAAQS as long as the air entering the State at its western and southern boundaries already exceeds that standard. While the IIP indicates EPA's interest in regional control measures to reduce regional transport and support attainment of the current NAAQS and the new or revised NAAQS, NYSDEC remains concerned with the progress of regional transport remediation. As a member of the Ozone Transport Commission (OTC), New York has enacted several control measures beyond those required by the federal Clean Air Act in an effort to attain the existing ozone standard. We have also been active participants in the Ozone Transport Assessment Group (OTAG) in hopes of developing regional transport strategies and "leveling the playing field." At the same time, areas in the Midwest, and other states, have been granted exemptions from some of the basic requirements of the Clean Air Act, in particular reasonable available control technology (RACT) for sources of oxides of nitrogen (NOx) and volatile organic compounds (VOCs), transportation and general conformity, and new source review. This proposal fails to identify an EPA interim policy on these exemptions.

Regardless of the final outcome of the proposed amendments to the ozone and PM NAAQS, it is crucial to attainment in New York that the large sources of ozone precursors located in the Midwest and southeast be required to install the same level of controls currently required in New York and others in the OTC. In this manner, air quality of this entire region will experience needed benefits, and the northeast will be able to compete on more equal footing with these states. As such, NYSDEC believes it essential that EPA promptly reevaluate the NOx exemptions granted in the Midwest and other areas from the perspective of more accurately assessing the effects such waivers have on air quality in downwind areas and on local air quality. NYSDEC further calls upon EPA to reassess the status of areas that it deemed to be "clean data" areas. Many of these areas are again violating the existing ozone standard and do not have even minimum controls in place. Further, it is likely that most of the remaining so called clean data areas would be reclassified as nonattainment when the new ozone standards are promulgated. It is clear that the IIP needs to assure national consistency of EPA enforcement of the Clean Air Act. EPA should consider making its SIP processing policy and regional consistency mechanisms federal rules to enable states and the public to monitor and ensure fair application of exemptions; both dejure and defacto.

Effective Dates

The IIP, as proposed, would take effect upon promulgation of the new or revised NAAQS and remain in effect in an area until EPA approval of the area's SIP revision for achievement of the new or revised NAAQS. The length of time this interim policy remains in effect, according to the proposal, could be several years and depends on the time necessary for states to develop new SIPs and subsequent approval by EPA. NYSDEC is concerned that the duration the IIP remains in effect will be too long. We strongly urge EPA to expedite its SIP approval process, which has been slow in the past, so that areas may commence orderly implementation of their revised SIPs. Otherwise, control measures will be unnecessarily delayed, especially in newly designated nonattainment areas, and the public will not begin to realize the air quality and associated health benefits of the new or revised NAAQS.

Designations, Redesignations and Classifications

There are vast areas of the country with no air quality data. We are encouraged by the efforts of EPA to explore spatial averaging of air monitoring data, as we believe this concept could have merit in examining air quality trends and establishing attainment/nonattainment boundaries. As such, to facilitate appropriate air quality designations in areas with no data, our scientists advise averaging proximate air monitoring data. This data averaging technique results in a more robust data set which could be used for initial designations of these otherwise unclassifiable areas. This contrasts with current policy to use site specific data to characterize attainment in surrounding metropolitan statistical areas and consolidated metropolitan statistical areas. Yet, we want to make it clear that more monitoring is needed to ultimately show attainment and nonattainment. For areas where air monitoring coverage is adequate, NYSDEC supports the continued use of site specific data.

The proposed revisions to the NAAQS allow two years, with a possible extension of another year (very likely in the case of PM fine), for the designation of "new" nonattainment areas. NYSDEC believes that, wherever reference method air quality data is already available, EPA should promptly designate (possibly within 120 days of the promulgation of the new NAAQS) new ozone nonattainment areas. Delaying the designations of such areas will only continue the status quo; that is, the unlevel playing field between the northeast and the Midwest and the southeast. As written, the IIP could effectively grant the new nonattainment areas, many of which are the target areas for OTAG, at least five and likely ten years (two to three years to designate, minimum of eighteen months to prepare SIPs, another eighteen months to complete the SIP before sanctions, and two to four years to implement control measures) before the implementation of appropriate controls. Therefore, the IIP could unwittingly continue the current situation that fails to address pollutant transport issues and undermine the OTAG process by giving credence to the positions of states and areas electing to ignore or delay needed regional progress toward abatement. Instead, EPA should require areas already not meeting the new NAAQS to expeditiously implement, at a minimum, cost-effective controls such as NOx and VOC RACT and gasoline vapor recovery (or comparable measures)

The EPA is also proposing that ozone nonattainment areas with clean air quality data at the time of promulgation of the new or revised NAAQS may be redesignated to attainment provided they satisfy the criteria of section 107(d)(3)(E), including having a fully approved SIP and an approved maintenance plan. We feel that this criteria should include "good faith" attainment planning. If an area subsequently measures nonattainment, provisions for expedited SIP calls and other requirements will be needed. Furthermore, it is vital that these maintenance plans for clean data areas have fully adopted contingency control measures and a commitment to use them. Otherwise, backsliding and transported pollution is likely.

With the onset of new or revised air quality standards, EPA must maintain the current provisions of the Clean Air Act for designating nonattainment areas. These provisions have been successful, are supported by enacted legislation, and are understood through our experience with the OTAG process to be more effective at reducing pollutant transport than starting anew with the area of influence/area of violation (AOI/AOV) methods.

The proposed IIP indicates that, consistent with the no-backsliding principle, those areas which failed to attain the PM-10 NAAQS in 1994 should have been reclassified as serious PM-10 areas. NYSDEC agrees with EPA's assertion that the requirements for serious areas would still apply, since the deadline by which to reclassify to serious was before the June 1997 NAAQS promulgation.

Progress Requirements and Attainment Demonstrations

NYSDEC supports EPA's position that, during the interim, current serious and above ozone nonattainment areas should continue to apply the ROP requirements of the Clean Air Act while shifting their planning efforts toward demonstrating attainment of the new ozone standard. However, the IIP also calls for states to submit, within 90 days of promulgation of the revised ozone standard, an early assessment of the NOx and VOC percent reductions necessary for serious and above nonattainment areas to attain the revised ozone NAAQS.

Because EPA's current regulatory model (UAM IV) has not been validated for this early assessment, NYSDEC believes that such an assessment should be optional as it may place an undue burden upon the states. Therefore, until this validation, or the validation of another regulatory model, takes place, any assessment resulting from its use would be of little value. We can only show our commitment, allocation of resources, and monitoring and inventory data. It is certainly not appropriate for EPA to subject states that fail to submit an early assessment to sanctions.

New Requirements for Marginal and Moderate Areas - Ozone

The IIP as written requires States with moderate and any remaining marginal nonattainment areas that do not attain the 1-hour ozone NAAQS by November 15, 1996 to submit, within eighteen months after promulgation of the new ozone NAAQS: (1) a nine percent ROP plan or

an attainment demonstration for the new NAAQS and (2) appropriate new source review requirements. One exception to this pertains to areas meeting the requirements for an extension under provisions of section 181(a)(5) of the Clean Air Act. This section allows EPA to grant an extension of the attainment date (i.e. November 15, 1996) to areas that are not showing attainment if the area has met the requirements of the applicable implementation plan and has not recorded more than one exceedance of the ozone NAAQS in the year preceding the extension year. NYSDEC believes it reasonable to permit submittal of such extension requests upon EPA certification of 1996 final air quality data.

Substitutions of Credits for Emission Reductions

The proposed IIP allows an ozone nonattainment area to take credit for emission reductions from sources outside the nonattainment area for the post-1996 and post-1999 ROP requirement so long as the sources are no farther than 100 km for VOC sources or 200 km for NOx sources. NYSDEC opposes these substitutions during the interim period on the basis that they permit backsliding. As many upwind areas continue to neglect compliance with section 110(a)(2)(D) of the Clean Air Act, emission reductions beyond ROP reductions are necessary within serious and above nonattainment areas for these areas to meet the NAAQS. Thus, there is no latitude for substitutions in these nonattainment areas. NYSDEC also requests justification of EPA's selection of the distances that outside sources must be within in order to apply substitution of credits.

Within the IIP, EPA is further proposing to allow states with areas having approved NOx waivers to substitute NOx reductions from outside of the nonattainment area for VOC reductions within the attainment area, if accompanied by technical justification. This conflicts with EPA's approval of the NOx waivers. That is, these waivers have been granted to areas in the Midwest and southeast without considering the effects of pollutant transport on downwind nonattainment. It is not appropriate to suddenly and conveniently consider the substitution of upwind NOx for VOC reductions in these exempted areas. New York, therefore, argues against allowing such outside NOx for inside VOC substitutions for areas with NOx waivers in the interim and for as long as these waivers remain in effect.

The IIP proposes not to allow substitutions for PM in and outside of the nonattainment area during the interim period. We support this position, until and unless creditable modeling shows these substitutions to be superior.

New Source Review - Ozone

EPA is proposing to continue the implementation of the existing new source review (NSR) requirements with respect to ozone and PM under the policy of no backsliding. While we support no backsliding, NYSDEC feels that technology driven programs are more effective at controlling emissions from new source growth than the NSR offset process itself. New and modified sources in both nonattainment and attainment areas within the Ozone Transport Region

(OTR) are subject to NSR requirements, including NOx and VOC offsets. In contrast, attainment areas outside the OTR do not have to obtain offsets. To address this inequity and release the choke hold that NSR offsets have placed on economic growth, we believe that alternative means of managing emissions growth are appropriate.

At a minimum, VOC offsets should not be required in the attainment areas of the OTR. Equity with attainment areas outside of the OTR aside, regional scale modeling has shown that VOC reductions generally yield local ozone benefits. New York argues that a VOC offset program in nonattainment areas is unnecessary if the other programs are used to manage growth.

Offset requirements could be eliminated if a technology mechanism was adhered to (e.g., BACT in attainment areas and LAER in nonattainment areas) and it could be demonstrated that: 1) anthropogenic VOC emissions will not exceed the lesser of 1990 levels or the maintenance budget in attainment areas or ROP levels in nonattainment areas; and 2) VOC emissions, through a technical analysis, from these areas do not have a significant impact on a (or another) nonattainment area.

Elevated NOx emissions from major sources are most associated with the problem of transport. NOx emissions from major elevated sources can contribute to ozone levels far downwind from their sources. NYSDEC recommends that new source offsets remain in place for NOx emissions in nonattainment areas and this program be expanded to significant new sources in attainment areas potentially contributing to nonattainment areas unless an alternative plan can be implemented. An alternative to new source offsets could be a budget program (such as the OTC NOx Budget Program). The budget program would have to include all sources affecting downwind air quality unless a limitation of a certain percentage of a state's or region's NOx target could be established (reducing the budget to offset the new emissions), or these sources are opted into the OTC NOx Budget Program.

New Source Review - PM

In its proposal, EPA indicates that NSR of fine particulate matter "...will not be required until EPA promulgates amendments to the existing NSR requirements concerning any newly-regulated form of PM under the integrated implementation program and SIP's are revised accordingly and approved by EPA." NYSDEC believes that the phrase ..."and SIP's are revised accordingly and approved by EPA" should be eliminated. As soon as EPA promulgates a new source performance standard (NSPS) which regulates PM fine, the applicant must address that limit, regardless of whether EPA has approved or a state has submitted a SIP to cover that aspect of NSR. In those instances, EPA retains the authority and responsibility to issue the NSR permit because that NSPS or prevention of significant deterioration (PSD) category has yet to be delegated to the state. This change in language seeks to redress the suggestion that an applicant need not deal with an applicable PM fine NSPS or PSD requirement until and unless that state has received approval from EPA on its SIP revision.

In the proposed revisions to the PM NAAQS, EPA proposes an alternative to revoke the 24-hour PM-10 standard. We feel that revoking the 24-hour standard will weaken the PSD program for significant facilities, as an examination of the effects of increased ambient levels or emissions of PM-10 upon existing permit limits or short term increment consumption will no longer be required. This, seemingly, is backsliding. Also, our stationary source allowable emissions are based upon total suspended particulates stack testing. Until stack test methods and appropriate emission standards have been adopted for PM fine, we have no other way to correlate stack emissions with air quality impacts.

In conclusion, New York supports the efforts of EPA to establish an interim implementation policy, based on the principles of no backsliding and continued progress, during the transition to the new or revised ozone and PM air quality standards. Again, thank you for providing New York with this opportunity to present our viewpoints on this matter.

Sincerely,

David Sterman
Deputy Commissioner

cc: Commissioner John Cahill (NYSDEC)
Jeanne Fox (EPA-Region II)
Jason Grumet (NESCAUM)
Bruce Carhart (OTC)

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New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-

John P. Cahill
Acting Commissioner

MAR 12 1997

U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center (6102)
Attn: Docket #A-96-51 Particulate Matter Monitoring Proposal
Waterside Mall, 401 M Street, SW
Washington, D.C. 20460

Dear EPA Docket Representative:

The New York State Department of Environmental Conservation (DEC) would like to thank the Environmental Protection Agency (EPA) for the opportunity to comment on proposed revisions to the air monitoring network as regards Particulate Matter 10 microns or less in diameter (PM_{10}) and Particulate Matter 2.5 microns or less in diameter ($PM_{2.5}$), as contained in the December 13, 1996 Federal Register (61 FR 65780). DEC commends EPA on its efforts to comply with the requirements of the Clean Air Act and establish the requirements for air monitoring networks which will generate the data needed to develop programs to protect the public health.

DEC, however, has concerns with EPA's proposals on how particulate matter will be monitored. Highest among our concerns are the needs for maintaining a credible monitoring network, and the increased costs and manpower requirements of the proposals. We believe that the proposals, as written, will require us to site over 30 new (and unfunded) $PM_{2.5}$ monitors, including 15 core sites. We urge EPA to consider the costs of these monitors, and of all of the changes it proposes, when considering funding levels for grants under Section 105 of the Act. Our comments regarding the proposal are detailed below:

DISCONTINUATION OF SITES

In the Preamble it is stated that "PM_{10} sites not needed for trends or for monitoring in areas with relatively high PM_{10} concentrations would likely be discontinued in a longer-term PM_{10} network." New York disagrees with this comment. The existing PM_{10} monitoring network should be maintained and kept intact for trend and historic data purposes. Once a monitoring site is discontinued, it is almost impossible to reestablish. If the site is dedicated solely to monitoring one pollutant and is discontinued, items such as easements, power supplies, and even the monitors themselves, may be lost forever. Much work, expense and expertise have gone into these monitoring networks over the years, and any claim to "save significant resources" by discontinuing monitoring at certain selected locations is not realistic.

DAILY SAMPLING IN PM_{10} NONATTAINMENT AREAS

DEC agrees with the proposal to no longer require daily sampling for PM_{10} in nonattainment areas. This requirement has been infrequently used, and does not contribute anything toward improved air quality. Additionally, there is no statistical basis for daily monitoring, or any evidence of any kind which shows that daily monitoring for particulate matter provides a better basis for data collection, or the development of air pollution control programs.

OPERATING SCHEDULE

EPA proposes daily monitoring for all core SLAMS $PM_{2.5}$ samplers, with the justification of there being little $PM_{2.5}$ measurement data (Preamble, IV.B). DEC opposes this proposal. New York has been performing $PM_{2.5}$ monitoring, and does have a database. EPA should give New York some credit for the monitoring it is already performing and its use of the monitoring data to implement strategies which properly consider the impact of the long-range transport of pollutants. Implementing new sampling should be purposely designed to enhance, and not replace, existing efforts.

DEC would also like to remind EPA that, historically, monitoring for particulate matter has always started out on a "one-in-six" day basis, and then increased in frequency according to need. This method has proved to be effective in our past efforts to comply with particulate matter NAAQS, including times early in the program when little particulate matter data was available.

DEC is also concerned about the directions given in the Operating Schedule regarding varying the frequency of sampling (58.13.2). These directions are open-ended, and may result in decisions to reduce sampling being made on the basis of arbitrary, and inconsistent, reasons. If EPA proceeds with its decision to require daily sampling, DEC encourages EPA to reevaluate this section.

MONITORING METHODOLOGY

EPA proposes to monitor $PM_{2.5}$ daily, with manual, filter based methods. DEC disagrees with this proposal as we feel we need the flexibility to use continuous fine particulate samplers and maintain the existing frequency of manual sampling. Everyday manual monitoring at some or all monitoring stations will be labor intensive, and is neither appropriate nor cost-effective. DEC also disagrees with EPA's reasoning to use filter-based methods for both comparison to the standard, and subsequent metals (or other species) analyses. DEC would like to remind EPA that the purpose of the monitoring network is to generate data for comparison to the standard. Additional analysis of samples is a secondary function, and is not required by the Clean Air Act itself. Generating data for secondary analysis is better suited to special purpose monitoring. In addition, sample speciation may not be necessary in all areas, particularly those in attainment of the standards.

DEC proposes two possible alternatives to the daily, filter-based method, monitoring proposal. The first alternative would be to use continuous fine particulate samplers as the reference method. These samplers could be telemetered into the data acquisition system, providing better and faster data recovery than manual methods. An additional benefit to the use of continuous samplers is that these monitors provide data on a shorter time scale (hourly) than filter-based methods (daily). This would provide a better correlation of ambient particulate matter levels to events - such as idling diesel buses at a garage - which influence pollution levels. A possible second alternative would be the use of weekly wet deposition anion and cation analysis from the existing acid rain network in New York for fine particulate composition data.

SPECIAL PURPOSE MONITORS

EPA proposes that all data should be entered into the AIRS data base regardless of how it was obtained, that is whether it was obtained from the required monitoring network or from a "Special Purpose Monitor" (SPM). The problem here is that SPM's are not required to sample with Federal Reference or Equivalent Method instrumentation and are not bound by rigid QC/QA requirements. This approach of accepting <u>any</u> data collected, even without proper controls, can result in the data base losing its credibility. At the very least, all data accepted from an SPM should be flagged as such, or should be kept in an isolated file within the data base and labeled appropriately.

MONITORING NETWORK COMPLETION

EPA approval of the sequential or continuous monitors required by this proposal is not likely until mid-1997, and the monitors themselves are not likely to be available until late in 1997. DEC has concerns as to whether it can meet EPA's proposed monitoring plan schedules due to this circumstance.

DEC also feels that EPA's proposal severely limits New York's ability to establish a network that will be best suited for our requirements and fiscal constraints. While EPA allows the use of alternatives to reference method monitors (the *Equivalent Methods*, as defined in Appendix A to Subpart A of Part 53, §53.1), it does not clearly define acceptability criteria, or establish test procedures for these alternatives. We would like to examine these alternatives, but would be hesitant to commit to them for fear of a later EPA disapproval of these instruments. The proposal, as written, forces DEC to choose from only a small selection of monitors. We also want to point out that New York's fiscal constraints are such that we cannot fully implement our network unless EPA approves the use of continuous monitors.

QUALITY ASSURANCE

DEC has concerns regarding EPA's proposed changes to Appendix A. These concerns are detailed below:

1. Section 2.2 - With regard to the sentence starting with "Quality Assurance and Quality Control Programs must follow the requirements ANSI E-4 . . ." This is a requirement that is arbitrary in nature and will cause the needless expenditure of limited resources with little or no commensurate gain in program quality. The ANSI E-4 document referred to is an excellent guidance document, useful for defining the philosophy necessary for development of a quality program from management, planning and, execution perspectives. However, the existing quality assurance manual for DEC's Division of Air Resources already encompasses many of the items discussed in the ANSI standard. Other items required to be covered by the ANSI standard are of dubious value for the current program. For example, it is doubtful that the benefits incurred from developing a Standard Operating Procedure (SOP) for procurement of supplies would be worth anything near the time it would take to develop, and then maintain, such a SOP. Other observations on this item are that there is no timing allowed for the inclusion of such a requirement. It would have to be included immediately upon promulgation of the final rule. Lastly, it should be pointed out, that in contrast to other requirements and rulings, the State of New York has not had an opportunity to participate in the review process of the ANSI standard.

2. Section 6.0, Annual operational evaluation of the $PM_{2.5}$ Methods - No data has been provided in this, or any other part of this proposed rule to support the 15% requirement used throughout this section, and the remainder of this Appendix A. Therefore, this requirement should be dropped, and an alternative approach used to determine method adequacy. Perhaps the best way would be to use the data generated initially from the collocated samplers to derive control limits generated from real world data.

3. Section 6.1, - "All collocated measurements shall be reported, even those which might be considered invalid because of identified malfunctions or other problems occurring during the sample collection period." . . . . . "The EPA will calculate annual evaluations form the reported test measurements as described in Sections 6.2, and 6.3." DEC strongly disagrees with this proposal. Either measurements are valid, or they aren't. Generation of criteria used to pass judgement on monitoring programs must be based upon valid data.

4. Section 6.2.3 - The "banning" of all monitoring methods which exhibit poor precision and/or bias based potentially on the results obtained from as little as one site is of dubious value. If the focus of this effort is to generate quality data at a reasonable cost, then the price of failure must not be so draconian. The focus should be on improving the quality of data at the offending site(s). The prospect of disallowing data from all other sites which could be producing data of excellent quality based upon the performance of perhaps one site would be enormously and needlessly costly, and would do little to enhance the gathering of admittedly critical environmental and health related data.

SUBSTITUTION OF MONITORS

While the EPA's proposal requires new monitors for $PM_{2.5}$, it does allow substitution of PM_{10} samplers for $PM_{2.5}$ samplers under certain conditions.

DEC agrees with allowing substitution of PM_{10} samplers under the conditions given in the proposal. DEC also feels that integrating existing PM_{10} and Total Suspended Particulate (TSP) samplers with the proposed $PM_{2.5}$ network to maintain geographic coverage and historical trends, including trace metals and acid rain deposits, should be considered the best approach for data collection.

ARCHIVAL OF FILTERS

The requirement to archive all filters obtained from a $PM_{2.5}$ monitoring network is excessive and will not result in any significant amount of data being developed. An alternative would be to archive every third or sixth filters, preferably those filters from run dates identical to PM_{10} run dates.

DEC is not certain that the storage method, as proposed in section 10.17 of Appendix L, will be an effective method of sample preservation. Refrigeration may slow down chemical reactions, but not stop them. Dehydration during refrigeration may also affect the samples' integrity. New chemical species may be formed, and species which existed at the time of sampling destroyed, prior to analysis. This may bias, or completely invalidate, any final analysis of the filters. DEC encourages EPA to explore this issue further.

SPATIAL AVERAGING ZONES

DEC has concerns over the use of spatial averaging for $PM_{2.5}$. We agree with EPA's desire to establish monitoring networks which are similar to the way the epidemiological studies which were used to establish the Particulate Matter standards were conducted. We also feel that area-wide averaging will better represent the pollutant levels that the general population is exposed to, as it will help compensate for the limited spatial area an individual monitor's data truly represents. While we can see the value in using spatial averaging, once a phase-in period is completed, as a tool to better define attainment/ nonattainment boundaries, identify areas of long range transport and establish air quality trends, we cannot completely buy-in to EPA's proposal until certain problems with network design criteria and other aspects of the program are resolved.

We understand that EPA has recently issued guidance on monitor siting and network design. Because this guidance was issued so close to the deadline dates for these comments, we have not had time to review the guidance prior to submitting these comments. Therefore, our comments reflect only what we read in the above referenced Federal Register notice.

The use of averaged values may result in situations where individual monitors consistently show exceedances of the annual standard (i.e., "hot spots") while the averaged data from monitors within a network shows attainment. In addition to the obvious air quality concerns this will raise, a problem of perception will be created; people who live or work near the monitor with the high average will feel that their air is unhealthy. The argument that the monitoring zone they live

or work in is in attainment will give them little satisfaction. At a minimum, this will create a difficult public relations situation for both DEC and EPA. Neither the Particulate Matter nor the Monitoring Proposal provides instruction on how states are supposed to manage this type of situation. EPA needs to address the handling of these "hot spot" issues prior to requiring the use of spatial averaging zones.

We note that the proposal requires the spatial averaging zone include only those monitors which give readings of within ±20% of the average of the zone. This ±20% requirement seems arbitrary, and, in our reading of the proposal, we could find no justification of how this value was established. The average of the zone will be a moving target, and data generated from monitors within any particular zone may have to be discarded periodically as averages are determined. It makes more sense to us to include all QA/QC'd data, except that generated from special purpose monitors, whenever averaging.

DEC also finds the proposal's guidelines on how the zones are to be established to be unclear and subject to much interpretation. It is possible for two or more professionals to review these guidelines, then design networks to cover the same geographical areas, which are vastly different from one another. The designs of any monitoring networks based upon these instructions will therefore be subject to considerable challenge upon their establishment. Also, there will be temptation to "average-out" of problems by redesigning networks to balance monitors with consistent high readings with those which read consistently low.

The question of determining nonattainment areas from the results of spatial averaging is also unclear. After design, a zone may or may not fall along the same political boundaries where air quality control areas have been traditionally located. If a spatially averaged zone indicates an exceedance of the standard, does that zone become the nonattainment area, or is the nonattainment area established through the current methods of population density and municipal boundaries? If the traditional boundary lines are drawn, they may include more than one spatially averaged zone, or parts of individual zones. Where then are nonattainment areas established? These questions should be answered before EPA proceeds with this concept.

DEC also has concerns with the use of microscale monitoring sites as part of spatial averaging zones, and for attainment determinations in general. While the proposal indicates that neighborhood scale monitoring is the preferred method, it leaves the door open for the use of microscale monitors in certain unique situations, all of which seem to have their basis in mid-town Manhattan in New York City.

Incorporating microscale monitors into a spatial averaging zone will create problems. The differences in monitored results shown from comparing microscale monitored sites to neighborhood scale sites located in close proximity (e.g., comparing the Madison Avenue microscale site to the PS 59 neighborhood scale site), will make it difficult for such sites to meet the ±20% rule. In addition, EPA desires to use spatial averaging as a way to mirror the way the

epidemiological studies used to develop the $PM_{2.5}$ were conducted. To our knowledge, these studies did not use microscale monitors.

Although we support early use of New York's current QA'd $PM_{2.5}$ data base, we strongly oppose any use of microscale monitoring in spatial averaging zones, or as a method to demonstrate attainment of any NAAQS, until such time as EPA clearly establishes, through regulation, how microscale monitors are to be incorporated into monitoring networks and used as a measure of attainment. Until such time, microscale monitors should be classified as "special purpose monitors," and not used for any other purpose.

DEC recommends that EPA continue to refine the concept of spatial averaging, but not require its use for attainment demonstrations until a robust set of data has been collected by which spatial averaging zones may be established. We also intend to discuss the use of spatial averaging as a means of showing compliance with the secondary ozone standard, through our comments on the proposed changes to the ozone NAAQS (Docket A-95-58).

Thank you once again for the opportunity to comment on these proposals.

Sincerely,

Dave Sterman
Deputy Commissioner

cc: Acting Commissioner John Cahill (DEC)
Jeanne Fox (EPA-Region II)
Jason Grumet (NESCAUM)
Bruce Carhart (OTC)

bcc: J. Austin
C. McCarthy
A. Fossa
S.T. Rao
D. Shaw
R. Sliwinski
J. Ralston
S. Botsford
M. Cronin
T. Gentile

SB/DS:al
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FILE:

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

John P. Cahill
Acting Commissioner

U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center (6102)
Attn: Docket # A-95-58 Ozone NAAQS
Waterside Mall, 401 M Street, SW
Washington, D.C. 20460

Dear EPA Docket Representative:

The New York State Department of Environmental Conservation (DEC) would like to thank the Environmental Protection Agency (EPA) for the opportunity to comment on proposed revisions to the Ozone National Ambient Air Quality Standards (NAAQS), as contained in the December 13, 1996 Federal Register (65716). We also commend the EPA for its efforts to meet the requirements of the Clean Air Act and develop air quality standards which protect the public health. DEC supports EPA's proposal to change to the ozone NAAQS to a value of 0.08 parts per million (ppm), averaged over an eight hour period. DEC does not support either alternate proposal of 0.07 or 0.09 ppm, averaged over the same period. In addition, DEC does not support the alternative of retaining the current primary standard of 0.12 ppm, averaged over one hour. Our comments on the complete proposal are detailed below.

DEC is concerned with the public health and environmental impacts of ozone. However, we cannot attain these proposed NAAQS without EPA's recognition of the transport issues which affect the levels of ozone New York State experiences, and EPA's assistance in addressing these issues. As such, we urge EPA to develop and enact national control programs such as those proposed to address the emissions from diesel locomotives, heavy duty diesels, fuels, and consumer products, because New York cannot control either the sources outside of its borders or mobile sources which travel to our state.

DEC supports EPA's selections of the averaging times and levels of the standards, as stated above. We have established that the standards have been chosen on the basis of the best scientific evidence available, and in accordance with the requirements of Sections 108 and 109 of the Act. We recognize that current scientific studies have been unable to establish a level at which there is no risk, and that Congress has not mandated that the EPA establish air quality standards to reflect a level of zero risk. We also recognize that the database regarding the effects of ozone on health is constantly growing, and encourage EPA to meet its obligation to review the NAAQS every five years, as is required by Section 109 of the Act.

FORM OF THE STANDARD

DEC supports the proposed concentration-based form of averaging the third highest annual exceedance over a three year period. We believe that such a form will allow us to account for extreme changes in meteorology which effect ozone formation, and, just as important, cannot be controlled. We do not support the idea of setting the standard at the lower end of the range (i.e., first or second highest annual exceedance), as we do not believe this would provide us with sufficient stability. We do not support setting the standard at the upper end of the range (fourth or fifth highest annual exceedance), either, as we do not believe that such a standard will adequately protect public health.

COMMUNICATION OF PUBLIC HEALTH INFORMATION

DEC has concerns over how changing the standard from a one hour-based exceedance to an eight hour-based exceedance will affect the Pollutant Standards Index (PSI), and how we are supposed to determine the PSI. Forecasting eight hour maximum concentrations will be more difficult than forecasting one hour concentrations, and a decrease in accuracy could cause a loss of credibility. In our comments on the particulate matter NAAQS proposal, we encourage EPA to examine the PSI to incorporate $PM_{2.5}$ and regional haze into this important health indicator. We recommend EPA explore this issue further.

SECONDARY STANDARD

DEC supports the establishment of the secondary standard of 25 ppm-hours, based on the proposed "SUM06" method. While we recognize the importance of protecting the public from exposure to ozone, we also are aware of ozone's effects on vegetation. The establishment of this secondary standard and having it in effect during the three-month ozone season, which is also New York's primary agricultural growing season, will be to the benefit of our farming communities.

ENHANCED MONITORING IN RURAL AREAS

DEC supports network expansion in rural areas, but feels that the proposal's discussion of this concept is vague and needs to be better defined by EPA. DEC also encourages EPA to explore the concept of "spatial averaging" as a method of determining attainment boundaries for the secondary standard, for those areas where monitoring coverage is not adequate. We have considerable concerns over the use of spatial averaging as a method to determine attainment with the proposed $PM_{2.5}$ NAAQS, and discuss them in our comments on the Particulate Matter Monitoring Proposal (Docket A-96-51). We do feel that the concept has merit, and should be examined as a possible method for determining compliance with both the primary and secondary ozone standards over large rural areas, where the cost of an expanded monitoring program may be prohibitive. We believe spatial averaging has the promise of better identifying the boundaries of attainment and nonattainment areas, eliminating the need for the use of "unclassifiable"

designations. DEC wants to make it clear, however, that more monitoring is needed in many areas to credibly demonstrate attainment and nonattainment.

DEC also encourages EPA to examine and reevaluate all of its network design and monitor siting criteria for ozone, as it is essential that optimum monitoring networks are designed to capture the true levels of ozone present in the ambient air.

DATA COMPLETENESS

DEC agrees with EPA's proposal to examine the use of meteorological data as a source of back up information to predict probable ozone concentration for those days that show no apparent exceedances, but are missing hourly values. We believe, however, that this should only be done at the end of the ozone season when it has been determined that a site has less than 90% completeness and no measured exceedances. To do this on a daily basis may be too large a workload on our forecasting staff, considering their normal duties during the summer months.

ROUNDING CONVENTIONS

DEC supports the convention of rounding the three-year average to the second decimal place for comparison to the standard. DEC also agrees that EPA's reasoning of basing the rounding conventions of the standard on the sensitivity and calibration requirements of the monitors. Any attempt to establish a standard beyond the abilities of the instruments is not founded in good engineering practices, and would lead to uncertainty as to the true attainment or nonattainment status of any particular area.

OTHER ISSUES

Our final comment regards funding. The process of bringing New York's air into compliance with the new standards, and maintaining that compliance, will require adequate funding. We urge the EPA and Congress to consider these costs when considering funding levels under Section 105 of the Act.

DEC would once again like to thank the EPA for the opportunity to comment on this proposal.

Sincerely,

David Sterman
Deputy Commissioner

cc: Acting Commissioner John Cahill (DEC)
Jeanne Fox (EPA-Region II)
Jason Grumet (NESCAUM)
Bruce Carhart (OTC)

bcc: J. Austin
C. McCarthy
A. Fossa
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New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-

MAR 12 1997

John P. Cahill
Acting Commissioner

U.S. Environmental Protection Agency
Air and Radiation Docket and Information Center (6102)
Attn: Docket # A-95-54 Particulate Matter NAAQS
Waterside Mall, 401 M Street, SW
Washington, D.C. 20460

Dear EPA Docket Representative:

The New York State Department of Environmental Conservation (DEC) would like to thank the Environmental Protection Agency (EPA) for the opportunity to comment on proposed revisions to the Particulate Matter National Ambient Air Quality Standards (NAAQS), as contained in the December 13, 1996 Federal Register (61 FR 65638). We also commend the EPA for its efforts to meet the requirements of the Clean Air Act and develop air quality standards which protect the public health. DEC supports EPA's proposal to establish annual and daily Particulate Matter standards based upon Particulate Matter 2.5 microns or less in diameter ($PM_{2.5}$), and the establishment of those standards at 15 and 50 $\mu g/M^3$, respectively. Our comments on the entire Particulate Matter proposal are detailed below.

DEC is concerned with the environmental and public health impacts of particulate matter. We are also aware that the same contaminants which are largely responsible for the formation of fine particulate matter are contributors to both acid rain and ozone, both of which adversely affect New York's air quality. DEC is also aware of the long-range transport issues associated with fine particulates, and believes the proposed $PM_{2.5}$ standards will help reduce the formation of these contaminants, thus preventing them from traveling into the northeast. We are encouraged that EPA recognizes the transport issue, and urge EPA to enact national control programs such as those proposed to address diesel locomotives, heavy duty diesels, fuels and consumer products, because New York cannot control either the sources outside of its borders, or mobile sources which travel to our state.

DEC support's EPA's proposals to set the primary standards at 15 and 50 $\mu g/M^3$ for the annual and daily standards, respectively, because they are based upon good scientific evidence. DEC does not agree with either alternate proposal of annual and daily standards set at 20 and 65 $\mu g/M^3$, or set at 12 and 20-50 $\mu g/M^3$. Our analysis of the health studies related to fine particulate matter determined that the risks of adverse health effects begin to increase when particulate matter concentrations approach the levels at which the primary standards are proposed. We recognize that there is no level at which our current scientific knowledge indicates that there is no risk, and that Congress has not mandated that the EPA establish air quality standards to reflect

a level of zero risk. Therefore, establishing the levels at the point of increasing risk is appropriate. Recognizing also that the scientific database on the health effects of particulate matter is constantly growing, we encourage the EPA to meet its Section 109 requirements and review the particulate matter NAAQS every five years.

FORM OF THE STANDARD

DEC supports the use of a concentration percentile form for the 24-hour standard, as this form of the standard will provide more stability to the standard than the one expected exceedance per year form currently in use for PM_{10}. The concentration-based form also allows for the fact that certain unique circumstances may occur which may temporarily adversely affect air quality, yet cannot be accounted for, predicted, prevented, or controlled. We would like clarification on why EPA chose the "98th" percentile as opposed to the "99th" percentile, especially since EPA states that there is no significant difference in health protection between the two percentiles. The 99th percentile comes closer to paralleling the ozone standard's "third highest annual" form. DEC feels it is important that the $PM_{2.5}$ and ozone standards have similar forms, as the two pollutants share many of the same precursors and have the same issues as regards transport.

SPATIAL AVERAGING ZONES

DEC has concerns on the use of "spatial averaging zones" for determining attainment of the annual $PM_{2.5}$ standard. We agree with EPA's desire to establish monitoring networks which are similar to the way the epidemiological studies which were used to establish the particulate matter standards were conducted. We also feel that area-wide averaging will better represent the pollutant levels that the general population is exposed to, as it will help compensate for the limited spatial area an individual monitor's data truly represents. We see value in using spatial averaging, once a phase-in period is completed, as a tool to better define attainment/ nonattainment boundaries, identify areas of long range transport and establish air quality trends. However, we cannot completely support EPA's proposal as it relates to spacial averaging until the problems we have with the concept's application, including the proposed network design criteria, are resolved. We will be commenting on spatial averaging in more detail in our submittal on the Particulate Matter Monitoring Proposal (Docket #A-96-51).

EPA proposes an alternative of basing the annual $PM_{2.5}$ standard on the population-oriented monitor site within the monitoring planning area with the highest 3-year average annual mean. We disagree with this alternative. Establishing monitoring zones based on the average of monitored values, and then basing attainment demonstrations on only one monitor defeats the concept of averaging.

The use of averaged values is not without its problems, however. Averaging data may result in situations where individual monitors show exceedances while the averaged data from monitors within a network shows attainment. In addition to the obvious air quality concerns caused by these "hot spots," a problem of perception will be created; people who live or work near the

monitor with the high average will feel that their air is unhealthy. The argument that the monitoring zone they live or work in is in attainment will give them little satisfaction. At a minimum, this will create a difficult public relations situation for both DEC and EPA. Neither the Particulate Matter nor the Monitoring Proposals provide instruction on how states are supposed to manage this type of situation. EPA needs to address this concern prior to requiring the use of spatial averaging zones.

ALTERNATIVE OF REVOKING THE 24 HOUR PM_{10} STANDARD

DEC opposes the proposed alternative of revoking the 24-hour standard for Particulate Matter 10 microns or less in diameter (PM_{10}), as we feel that some form of a short term "coarse" particulate standard is necessary to help the state address air pollution nuisance and compliance issues. The removal of a short term standard will also create public relations concerns, as PM_{10} data will still be generated on a daily basis, and the public will perceive that air quality is threatened if monitoring data ever shows violations of the former daily standard, and then discovers that New York has no legal recourse to address these "exceedances." Further, revoking of the 24-hour standard will weaken the new source review program for major facilities, as an examination of the effects of increased emissions of PM_{10} on short term increment consumption will no longer be required. This, coupled with the fact that EPA has not addressed the need to include evaluations of $PM_{2.5}$ increment consumption in the new source review program, takes away any federal requirement to evaluate the short term impacts of particulate matter when reviewing permit applications for new major facilities. We feel this is "backsliding".

PROPOSAL TO CHANGE THE FORM OF THE 24 HOUR PM_{10} STANDARD

DEC supports the changing of the form of the 24-hour standard from a "one-expected-exceedance" form to a concentration-based form, for the same reasons as we support the use of a concentration-based standard for $PM_{2.5}$. We feel that both the form of the PM_{10} standard and the frequency of PM_{10} sampling should be consistent with the conditions established for $PM_{2.5}$. Both pollutants should be sampled on a one-in-six day schedule, and have their short term standards evaluated on a percentile basis.

USE OF ACTUAL CONDITIONS

DEC agrees with the use of actual, rather than standard conditions for monitoring PM_{10}.

QUALITY ASSURANCE

EPA's proposed Quality Assurance (QA) Plan, as stated in Appendix L, 4.2.1 (Test of concordance), would require a precision check consisting of a biweekly flow check, and the use of collocated sampling six times per year for audits.

DEC is of the opinion that EPA's proposed Quality Assurance Plan will not produce any better results than the current QA plan, and is not consistent with existing QA methodologies. In addition, the proposal to have rotating co-located samplers seems excessive, especially as it relates to operator travel. An alternative would be to continue the use of traditional quarterly audits where the flow rate and mass weight accuracies are checked. Another alternative would be to require collocated manual samplers at a few continuous sites for precision testing using a 12 day sampling schedule. Performing duplicate sampling every 12 days produces enough pairs to perform statistical analyses on an annual basis, and would eliminate the need to integrate both types of tests for determining actual differences. We have found the traditional annual flow audit for accuracy and co-located samplers run every six days to be sufficient to establish precision and accuracy data for a PM monitoring network. If needed the frequencies of the flow audits could be increased to quarterly without any significant expense.

REFERENCE METHOD

DEC is not certain that the method, as proposed, will ensure that the mass fractions of individual species, such as oxides of nitrogen and volatile hydrocarbon emissions from mobile sources, will be accounted for in the final analysis. We disagree with section 6.10, which leaves the methods of subsequent chemical analysis of filters up to the individual state or source owner. The lack of a national, uniform method will allow for inconsistencies in analyses, and a weakening of the credibility of the national database.

OTHER ISSUES

DEC would also like to comment on the Pollution Standards Index (PSI) here, even though EPA is not soliciting comment regarding the PSI through its proposal on the particulate matter NAAQS. DEC encourages EPA to study the PSI in an effort to revise the PSI to include provisions for predicting levels of $PM_{2.5}$ exposure, and also to include regional haze in the PSI as well.

DEC also encourages EPA to examine the language it uses as regards "particulate matter" in its administration of the new source review (Prevention of Significant Deterioration (PSD)) and New Source Performance Standards (NSPS) programs. The PSD program should be amended to address $PM_{2.5}$ as a regulated air pollutant and NSPS should be amended to reflect both PM_{10} and $PM_{2.5}$. DEC feels that by amending the NSPS and PSD programs to reflect these changes, a needed consistency between the two regulations will be achieved. Also, past attempts by New York State to require that PM_{10} be included in the administration of these programs have been hampered by the unenforceability of the guidance documents EPA has submitted to these regulations, in lieu of revising the regulations to reflect the current set of criteria pollutants. The addition of $PM_{2.5}$ as some new criteria pollutant will only make the interpretation and enforcement of these programs, as they are written now, more difficult.

DEC encourages EPA to examine the source testing methodology for both PM_{10} and $PM_{2.5}$. There is no specific methodology in place for $PM_{2.5}$, and we have concerns as to the validity of adapting either of the reference methods currently being used for measuring PM_{10} (Reference Methods 201a and 202) for use in measuring $PM_{2.5}$. To our knowledge, the cascade impactors required in 201a have never been validated. Although we suspect that all of the condensibles in the back half of the sampling train used in 202 is $PM_{2.5}$, we would like EPA to examine this and provide concurrence. We strongly urge EPA to define the methods for compliance determination for both of these pollutants prior to revising the NAAQS and requiring the submittal of new or revised state implementation plans. Simply issuing guidance documents is not sufficient, as these documents often conflict with one another and lack the enforceability of regulation.

Our final comment regards funding. The process of bringing New York's air into compliance with the new standards, and maintaining that compliance, will require additional funding. We urge the EPA and Congress to favorably consider these costs when considering funding levels under Section 105 of the Act.

DEC would once again like to thank EPA for the opportunity to comment on this proposal.

Sincerely,

David Sterman
Deputy Commissioner

ec: Acting Commissioner John Cahill (DEC)
Jeanne Fox (EPA-Region II)
Jason Grumet (NESCAUM)
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bcc: J. Austin
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S. Botsford
M. Cronin
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FILE:

FOOD INDUSTRY ENVIRONMENTAL COUNCIL,
McLean, VA, May 27, 1997.

Hon. JOHN CHAFEE, *Chairman,*
Senate Environment and Public Works Committee,
U.S. Senate, Washington, DC.

DEAR CHAIRMAN CHAFEE: The Food Industry Environmental Council (FIEC) is pleased to submit these comments for the record for the Senate Environment and Public Works Committee's recent hearing addressing the Environmental Protection Agency's (EPA) proposed revisions to the National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter.

As you may know, FIEC is a coalition of food processors and food trade associations representing over 15,000 facilities employing approximately 1.5 million people in the United States. FIEC members operate facilities and distribute finished food products worldwide. If EPA were to revise the NAAQS for ozone and particulate matter as proposed, the processing and distribution of food in the United States would be impacted significantly.

The proposed revisions to the ozone standard would replace the current primary NAAQS with a standard using an 8-hour averaging interval and would replace the current secondary NAAQS with a standard based on a SUM06 formulation. The proposal for fine particulate would expand the current PM_{10} NAAQS with two standards using $PM_{2.5}$ as the pollutant indicator. One of the new standards would be based on a 24-hour averaging interval; the second new standard would be based on an annual averaging interval.

Under the proposed more stringent NAAQS, it would appear that State governments would have no option but to seek to achieve emissions reductions from many small sources which have not been subject to regulation in the past, which could have a particularly broad impact on the agriculture and food processing sector. This revised regulatory approach would multiply significantly the range of potential control options, creating a pyramiding impact on each segment of the food supply chain.

These impacts, without question, would create particularly significant regulatory burdens for large and small food processors, including many facilities and growers that rely on part-time and seasonal labor. Indeed, FIEC questions whether EPA has evaluated appropriately and thoroughly the potential impact of its proposals. While FIEC members fully support the goals of the Clean Air Act, the coalition questions the scientific basis that has been cited by the agency for proposing more stringent NAAQS for ozone and PM at a time when current regulatory programs are resulting in documented air quality improvements.

Because the proposed new NAAQS would impact each segment of the food production supply chain without any reliable indication of benefit to the public health, FIEC urges EPA to reaffirm the current PM standards and initiate a targeted research program to resolve the serious and pertinent questions raised in the Clean Air Scientific Advisory Committee's (CASAC) review of the scientific basis relied on by the agency to support the proposed rule. FIEC urges the agency to withdraw the proposed rule for ozone and to continue instead to build on the documented progress that has been gained through reliance on the current NAAQS.

AIR QUALITY IS IMPROVING UNDER CURRENT STANDARDS

The National Air Quality and Emissions Trends Report, 1995 issued recently by EPA shows that over the past 25 years, emissions and ambient concentrations of the six major air pollutants have decreased nationally by almost 30 percent. Furthermore, the significant reduction in the number of nationwide "non-attainment" areas for ozone from 98 areas in 1990 to 66 areas at the present time, abatement from existing State Implementation Plans (SIPs), and EPA's own forecast of continuing reductions in ozone precursor emissions under current and prospective Clean Air Act programs (such as the Title IV, acid rain program, and the Title III, hazardous air pollutants program) provide clear indications that the current standards are promoting improved air quality.

IMPACT ON "FARM TO TABLE" FOOD PRODUCTION AND DELIVERY

The United States boasts the finest "farm to table" food distribution system in the world. Unlike other countries, in which up to 50 percent of foodstuffs may be lost between the farm and the table, the United States loses less than 10 percent of foodstuffs through production and distribution channels. Likewise, U.S. consumers spend far less of their gross disposable income on food than consumers in any other industrialized nation. In large part, efficiencies in growing, processing and distributing food keeps costs to American consumers down.

There is broad consensus that the proposed new NAAQS would create new "non-attainment" areas for ozone and particulate matter. More specifically, it has been estimated that the proposed new standards would swell to roughly 335 the number of counties and areas that would qualify for "non-attainment" status for ozone, and 167 counties that would be considered "non attainment" for particulate matter. FIEC is concerned that "non-attainment" may spill over to rural areas which currently do not monitor ozone levels.

Significantly, these largely rural areas are the core of production agriculture and food processing. Farm mechanization, farming practices, distribution to and from processing facilities, process details and post processing distribution are likely to be affected by the proposal, thereby compromising the ability of the agriculture and food processing sectors to continue to provide an abundant, economical food supply to consumers.

At the start of the food production chain, the new standards implicate tighter emission and use controls for farm equipment, and restrictions on fertilization and crop protection application, among other potential control options, which could have a broad impact on crop yield and quality. New mobile source controls, including tighter emission controls for vehicles used to transport commodities to processing plants, would impact directly the quality and timely delivery of raw ingredients used in post harvest production.

State governments, which already have placed controls on numerous areas, likely would be pressed to target food processing plants, which are negligible sources of emissions, as new control sources in order to comply with the proposed more stringent NAAQS. Finally, the expedient and economical distribution of finished foods, a critical link in assuring foods from the farm reach consumers' tables, would be impacted by control strategies such as reformulated fuel requirements, engine emission standards, alternative fuel programs, inspection requirements, retrofitting and rebuilding of existing engines, and operational restrictions. These control options would jeopardize the efficient system which keeps an abundant and economical supply of fresh and wholesome foods on American consumers' tables.

IMPACT ON SMALL BUSINESSES

Many growers and food processing facilities rely on part-time and seasonal labor and therefore fall under the Small Business Administration's (SBA's) definition of "small business." FIEC is concerned EPA has failed to consider the national impact of the proposed standards on small businesses, which have made such a vital contribution to the recent strength of the U.S. economy.

Importantly, FIEC questions whether EPA's proposal is in direct violation of the *Small Business Regulatory Enforcement Fairness Act of 1996* (5 U.S.C. §§601 *et. seq.*) better known as "SBREFA," which was passed last year by Congress with overwhelming bipartisan support. Under SBREFA, EPA is required before publishing a proposed rulemaking to issue an initial Regulatory Flexibility Analysis and to convene an advocacy review panel to collect small business input and make findings on the determinations reached in EPA's initial "regulatory flexibility" submission. Rather than taking these steps, the agency issued a certification that the proposed rule, if promulgated, would not have a significant economic impact on a substantial number of small entities. This certification was clearly inappropriate in this instance, given the significance of the likely impact of the proposal on small businesses.

LIMITATIONS AND SHORTCOMINGS WITH THE HEALTH DATA RELIED UPON BY EPA

CASAC, the agency's expert review panel established by the Clean Air Act, reviewed the technical and health information and analyses in the Criteria Document (CD) and the Staff Paper (SP) prepared by EPA for this rulemaking and concluded there were significant uncertainties and unanswered questions that had to be addressed. FIEC is concerned the proposed decision to set a $PM_{2.5}$ (fine particle) and a more stringent NAAQS for ozone does not reflect adequately the considerable uncertainty reflected in CASAC's analysis, and recommends EPA reaffirm the current standards and initiate a targeted research program to resolve the questions raised during the recently completed review process.

Particulate Matter

Court ordered deadlines have hindered the standards development process, as evidenced by the fact that the effect of exposure to ambient fine particle concentrations was not analyzed adequately by EPA. CASAC stated in its June 13, 1996, letter that the court "deadlines did not allow adequate time to analyze, integrate, interpret, and debate the available data on this very complex issue." Importantly, a number

of comments provided to the agency identify many areas in which there is a critical need for additional analytical work or data collection. CASAC stated that, "The agency must immediately implement a targeted research program to address these unanswered questions and uncertainties." FIEC agrees with CASAC and others that data and analytical shortcomings and research gaps are serious problems which should be addressed before a revised standard is adopted.

EPA's proposed decision to establish a fine particle standard is flawed because it fails to address numerous sources of uncertainty. In its June 13, 1996, closure letter CASAC stated that there are "many unanswered questions and uncertainties associated with establishing causality of the association between $PM_{2.5}$ and mortality." EPA's decision to regulate $PM_{2.5}$ in the face of these uncertainties, cannot be justified.

The agency has ignored a number of pertinent scientific issues in its overall approach to the review and risk assessment process. These include:

• contradictory results of other investigators (such as Drs. Moolgavkar, Roth, Stryer and Davis) as compared with those of the researchers emphasized in the SP;

• the paucity of $PM_{2.5}$ data and EPA's reliance on a single nationwide $PM_{2.5}/PM_{10}$ ratio;

• no access to $PM_{2.5}$ monitoring data for outside review and analysis;

• a lack of supporting toxicological and human clinical data;

• little correlation between central monitors and personal exposure;

• substantial measurement error associated with monitoring of ambient particulate matter;

• insufficient link between the epidemiological results and a specific component of air pollution (size or chemical composition);

• the confounding influence of meteorological conditions such as temperature and humidity, and other environmental irritants, allergens and agents; and

• no identified biological mechanism—that is, the lack of an identified physical cause for the alleged adverse health effects.

EPA has greatly oversimplified its approach to assessing the risk associated with exposure to fine particles. EPA's approach:

• generates misleadingly precise estimates of risk;

• greatly understates the degree of uncertainty associated with those risk estimates by not considering uncertainty about PM-health endpoint causation, nor does it consider, if PM is causal, uncertainty about the identity of the causative agent(s); and

• produces inflated risk estimates by ignoring the confounding effects of copollutants and meteorological variables, as well as background levels of particulate matter.

The most fundamental concern about the PM risk assessment and EPA's reliance on it for its proposed decision is the agency's failure to consider, or even to acknowledge sufficiently, the important uncertainties noted above. Instead, the risk assessment simply assumes that PM causes excess mortality and morbidity and that all PM species within a particular size range contribute equally to that risk, solely in proportion to their mass. Such assumptions substantially underestimate health risk uncertainty, implying a greater degree of certainty than actually exists.

EPA's proposed decision also does not account adequately for confounding bias in the epidemiological studies. The influence of confounders, such as stressful meteorological conditions and copollutants, has not been considered adequately by the agency. Much of the quantitative analysis in the SP which EPA relies on in its proposed rule is based inappropriately on studies which do not consider adequately these confounders. The final CD (page 13–92, 93) states, ". . . confident assignment of specific fractions of variation in health endpoints to specific air pollutants may still require additional study." Similarly, the SP states ". . . a more comprehensive synthesis of the available evidence is needed to evaluate fully the likelihood of PM causing effects at levels below the current NAAQS," and "[a]s noted above, it is too difficult to resolve the question of confounding using these results from any single city because of the correlations among all pollutants" (page V–54).

EPA dismisses the recent reanalyses of PM_{10} and total suspended particulate (TSP) epidemiological studies presented by the Health Effects Institute (HEI) and others which conclude a single causative agent cannot be identified among components of air pollution. EPA also ignores inconsistent and contradictory findings which resulted when different investigators analyzed data from the same location, e.g., Philadelphia, Steubenville, Utah, Birmingham and London.

Another major problem with the agency's proposal is that almost all the epidemiological studies upon which it relies uses PM_{10} or even TSP as the metric. EPA's Federal Register notice notes that of 38 daily mortality analyses listed in Table 12–2 of the Criteria Document "most found statistically significant associations" between

PM and mortality. EPA fails to note that only two of those studies used $PM_{2.5}$ as the metric. Moreover, the two studies that used $PM_{2.5}$ do not support EPA's proposed decision to establish fine particle standards. Importantly, neither study analyzed copollutants, and the results do not indicate that fine particles are the causative agent.

The agency proposal relies on studies that were conducted with data sets that have not been included in the docket for analysis by other investigators, as required by law. One key data set which falls into this category is the Harvard School of Public Health data consisting of particulate matter data for the "Six Cities" study. As noted by EPA in the SP and at other forums, the results of this study played a leading role in the development of the proposed rulemaking. FIEC urges EPA to comply with the Clean air Act and make these data sets available in the rulemaking docket for assessment by other investigators. Further, FIEC recommends EPA reaffirm existing PM standards at least until such time as these assessments are complete, and conflicting conclusions are resolved.

It should be noted that as early as May, 1994, in a letter to EPA Administrator Browner from CASAC, the agency was asked to "take steps to assure that crucial steps linking exposure to particulate matter and health responses are available for analysis by multiple analytical teams. . ." The CASAC letter also requested that "the EPA should take the lead in requesting that investigators make available the primary data sets being analyzed so that others can validate the analyses."

The agency has noted that a biological mechanism by which $PM_{2.5}$ could cause health effects has not been identified. Existing animal and chamber studies do not support a causal link between $PM_{2.5}$ and mortality or morbidity. FIEC agrees with the conclusion reached in a January 5, 1996, letter by many members of CASAC that "the case for a $PM_{2.5}$ standard is not compelling." This was reiterated numerous times at the May 16–17, 1996, CASAC meeting. The revised CD itself concludes, "A number of studies using multiple air pollutants as predictors of health effects have not completely resolved the role of PM as an independent causal factor" (page 13–92).

Since EPA has not established that fine particles are causing health effects, the proposed decision to establish new fine particle standards is not justified, and control programs designed to attain them would waste billions of dollars in unnecessary emission control costs. If, on the other hand, PM-health endpoint associations later prove to be causative and the causative agent(s) have not been controlled sufficiently (or at all), billions of dollars spent on the wrong emission control measures will have been wasted, with no public health improvement.

Ozone

According to CASAC, EPA's own analysis shows that none of the ozone standards under consideration by the agency—including one about as stringent as the current standard—is "significantly more protective of the public health." The significant uncertainties surrounding the agency's scientific basis for the new standard, considered together with the agency's acknowledgement that the costs of implementing the proposed new NAAQS for ozone could far exceed any benefit to be gained from the new standard, undermine any public policy justification for moving forward with the proposal. The agency simply has not made the case that the new standard is a necessary or appropriate regulatory response to a significant public health risk.

Chamber Studies

The chamber studies, on which EPA relies to support its proposal, are not representative of actual ozone exposure patterns recorded at monitoring stations or experienced by individuals. The activity patterns under which these lab studies were performed clearly do not represent daily patterns of sensitive populations targeted by the standards, and the concentration and exposure patterns do not represent actual patterns recorded at monitoring stations or experienced by individuals. Serious artifacts were introduced through experimental methods used in these studies, including the methods by which the ozone was produced and the composition of the air that was breathed by participating individuals. These studies clearly do not provide consistent, unambiguous results on which to base the proposed new standards.

Camp Studies

EPA also relies on a series of camp studies to support the proposed standards. The principal limitation of these studies is the inability to separate the influence of a single constituent, in this case ozone, from other potential environmental irritants. These irritants could include weather factors such as high temperatures, and naturally-occurring irritants such as pollen and organic compounds. None of the camp studies is capable of identifying the contributing influence of a single constituent within the air mixture.

Risk Assessments for Outdoor Children and New York City Hospital Admissions

These data do not support the need for more stringent standards. After carefully reviewing the EPA Staff Paper, CASAC in its November 30, 1995, closure letter stated:

> [B]ased on the results [of the two risk assessments], the Panel concluded that there is no 'bright line' which distinguishes any of the proposed standards (either the level or the number of allowable exceedances) as being significantly more protective of public health. For example, the differences in the [estimated] percent of outdoor children responding between the present standard and the most stringent proposal (8-hour, one exceedance, 0.07 ppm) are small and their ranges overlap for all health endpoints. [The initial results presented in the Staff Paper for risk assessment for hospital admissions, suggest considerable differences between the several options. However, when ozone-aggravated asthma admissions are compared to total asthma admissions, the differences between the various options are small].

A closer examination of the hospital admissions risk assessment shows that greater improvements in public health would be realized through attainment of the existing ozone NAAQS (from the "As Is" case to the "Existing Standard" option) than reliance on any of the alternative standards under consideration by EPA. CASAC could not link any improvement in public health to the adoption of any of the alternative options considered by EPA and ultimately concluded that "the selection of a specific level and number of allowable exceedances is a policy judgment."

CONCLUSION

Because the proposed new NAAQS for fine particulate mater and ozone would impact each segment of the food production supply chain without any reliable indication of benefit to public health, FIEC urges EPA to reaffirm the current standards and initiate a targeted research program to resolve the serious and pertinent questions raised in CASAC's review of the scientific basis relied on by the agency to support the proposed rule.

FIEC appreciates the opportunity to comment on this rulemaking.

Sincerely,

AMERICAN BAKERS ASSOCIATION,
AMERICAN FROZEN FOOD INSTITUTE,
AMERICAN MEAT INSTITUTE,
BISCUIT & CRACKER MANUFACTURERS ASSOCIATION,
CHOCOLATE MANUFACTURERS ASSOCIATION,
GROCERY MANUFACTURERS OF AMERICA,
INDEPENDENT BAKERS ASSOCIATION,
INSTITUTE OF SHORTENING & EDIBLE OILS,
INTERNATIONAL DAIRY FOODS ASSOCIATION,
MIDWEST FOOD PROCESSORS ASSOCIATION,
NATIONAL AGRICULTURAL AVIATION ASSOCIATION,
NATIONAL CATTLEMAN'S BEEF ASSOCIATION,
NATIONAL CONFECTIONERS ASSOCIATION,
NATIONAL FOOD PROCESSORS ASSOCIATION,
NATIONAL OILSEED PROCESSORS ASSOCIATION,
NATIONAL PASTA ASSOCIATION,
NORTHWEST FOOD PROCESSORS ASSOCIATION,
SNACK FOOD ASSOCIATION,
TORTILLA INDUSTRY ASSOCIATION.

NATIONAL CAUCUS OF ENVIRONMENTAL LEGISLATORS,
Washington, DC, April 28, 1997.

President WILLIAM J. CLINTON,
The White House, Washington, DC.

DEAR PRESIDENT CLINTON: This month the Nation celebrates the 27th anniversary of Earth Day. At the time of this observance, one of our most important public health issues and environmental concerns, is the Clean Air health standards proposed by the United States Environmental Protection Agency (EPA) to update the National Ambient Air Quality Standards (NAAQS) for ozone and particulate matter.

The National Caucus of Environmental Legislators (NCEL) was established by like-minded State legislators who share the bipartisan goal of States' involvement

in protecting the environment. For these reasons, and to counter the campaign of misinformation of those opposed to strengthening public health standards, we urge your Administration to adopt air quality standards which protect the health of all our citizens.

State governments, acting in partnership with the Federal Government, play an indispensable role in the effort to protect natural resources and combat environmental degradation and pollution. State implementation of Federal law is the cornerstone of our current system of environmental protection. States are particularly dependent upon the State-Federal partnership and Federal pollution control laws when dealing with the interstate migration and affects of pollutants. Federal, uniform standards of air pollution are essential; State lawmakers universally recognize that air pollution does not respect State boundaries. For this reason, we applaud EPA's efforts to address ozone and particulate matter ambient air pollution at the Federal level.

We support the concept that health standards for air pollutants should be based on peer reviewed science and designed to better protect human health. According to that scientific data, the current standards for ozone and particulate matter, in place since 1979 and 1987, respectively, are inadequate to protect our children, the elderly and the one-third of the American population who suffer from some form of respiratory ailment.

As State legislators, we have a responsibility to ensure that all of our constituents are able to breathe clean air, giving special attention to sensitive populations such as children, the elderly and individuals with pre-existing respiratory diseases. We expect EPA to set clean air standards which will achieve this objective. To implement these standards we expect EPA to provide sufficient funding to monitor and to characterize these pollutants so that States have the resources necessary to determine when, where and how often the new standards are exceeded.

According to EPA's estimates, the new particulate matter standards would save at least 15,000 lives each year, and the new ozone standard would result in up to 400,000 fewer incidents of aggravated coughing or painful breathing and 1.5 to 2 million fewer incidents of decreased lung functions. Furthermore, the updated standards would benefit millions of Americans by decreasing incidences of breathing problems, asthma attacks, bronchitis, and heart and lung disease. These new standards are supported by 19 of 21 members of the Clean Air Scientific Advisory Committee. In addition, a recent EPA study of the costs and benefits of the Clean Air Act from 1970 through 1990 found that every dollar spent on clean air regulation compliance resulted in $45 in benefits to public health and the environment.

With respect to the air quality standard for ozone, EPA determined that the current standard is inadequate to protect human health, and EPA's Clean Air Scientific Advisory Committee unanimously recommended that the standard should be based on an 8-hour exposure to ozone. Over 180 scientific studies on the effects of ozone found that serious health problems occur at exposure levels lower than the current standards, and that longer exposures may have more significant consequences.

We understand that these new standards will challenge State and local government to develop better air pollution control programs. The costs these standards impose are appropriately considered in the implementation process; the standards themselves should reflect solely the best scientific information on the effects of air pollutants on public health.

In conclusion, based on the near unanimous findings of the EPA's Clean Air Scientific Advisory Committee, we support efforts to assure Federal clean air standards

for ozone and particulate matter protect the health of all Americans, especially our children.

Respectfully,

SENATOR RICHARD L. RUSSMAN,
New Hampshire.

DELEGATE LEON G. BILLINGS,
Maryland.

SENATOR BYRON SHER,
California.

SENATOR REBECCA I. WHITE,
West Virginia.

REPRESENTATIVE ANDY NICHOLS,
Arizona.

REPRESENTATIVE DEBORAH F. MERRITT,
New Hampshire.

ASSEMBLYMAN RICHARD BRODSKY,
New York.

DELEGATE JAMES HUBBARD,
Maryland.

REPRESENTATIVE JAY KAUFMAN,
Massachusetts.

ASSEMBLYWOMAN LORETTA WEINBERG,
New Jersey.

REPRESENTATIVE DAVID LEVDANSKY,
Pennsylvania.

REPRESENTATIVE RALPH AYRES,
Indiana.

REPRESENTATIVE MARY M. SULLIVAN,
Vermont.

REPRESENTATIVE JOHN R. BENDER, PH.D,
Ohio.

REPRESENTATIVE BRIAN FROSH,
Maryland.

SENATOR PAT PASCOE,
Colorado.

REPRESENTATIVE JOE HACKNEY,
North Carolina.

REPRESENTATIVE MARY ELLEN MARTIN,
New Hampshire.

NORTHEAST STATES FOR COORDINATED AIR USE MANAGEMENT,
March 24, 1997,

Senator JAMES INHOFE,
Russell Senate Office Building,
Washington, DC.

DEAR SENATOR INHOFE: On behalf of the Northeast States for Coordinated Air Use Management (NESCAUM), a regional association of the eight States of Connecticut, Massachusetts, Maine, New Hampshire, New Jersey, New York, Rhode Island, and Vermont, I appreciate this opportunity to express our support for the Environmental Protection Agency's recently proposed revisions to the ozone and particulate matter National Ambient Air Quality Standards (NAAQS). Since 1967, NESCAUM has provided a forum for its member States to exchange information on air quality issues including those related to public health and welfare, and promote regional cooperation on pollution control strategies. Over the past several months, technical and policy staff from the environmental agencies in the eight northeast States have carefully examined EPA's proposed revisions to the NAAQS. Attached are detailed comments that we have submitted collectively, as well as comments supporting the proposed standards submitted independently by Massachusetts, New York, and Vermont.

The NESCAUM States support EPA's proposals to revise the ambient air standards for ozone and particulate matter and support the process by which EPA has

developed the proposed revisions. By relying on input received from independent national experts from academia, industry, and other organizations, EPA has rightly concluded that the primary ozone and particulate standards must be tightened in order to protect public health. We commend EPA on effectively utilizing the Clean Air Science Advisory Committee peer review process.

The primary mission of the environmental agencies in the Northeast is to protect public health and welfare. We firmly believe that the standards for ozone and particulate matter must be based solely on the best scientific assessment of the need to protect the public health and welfare. Some have commented that EPA should apply cost-benefit analysis in setting the standards. To put it simply, setting public health standards based on cost is bad science, bad policy, and just plain wrong. The public has a right to know when its health is at risk, particularly when individuals can take cautionary actions to diminish their exposure to harmful air pollutants.

Cost considerations are now and shall remain paramount as we move to adopt and implement pollution control strategies necessary to achieve health-based standards. As any environmental regulator can attest, it is virtually impossible to impose an air quality control requirement that cannot be justified on economic grounds. The question is not whether we factor cost into our analysis, but when. The appropriate answer is in implementing programs, not when determining the levels of pollutant concentrations that are needed to protect public health.

OZONE STANDARD

The NESCAUM States support the level and form of the primary ozone standard proposed by EPA (8-hour, 80 parts per billion). Although there is no exposure threshold that guarantees absolute protection for the entire population, we believe that the level of the 8-hour standard as proposed (80 parts per billion) is clearly more effective at protecting public health than the current standard. The 8-hour averaging time more realistically reflects the true regional nature of the ozone problem and will encourage more rational control strategies. Moreover, the form of the proposed ozone standard correctly targets areas with chronically elevated pollution levels. Under the proposed regime, States will be far less vulnerable to bouncing between attainment and nonattainment status on the basis of changes in summertime weather.

Having standards that reflect current scientific understanding of ozone formation will lead to more effective control programs. The existing standards reflect the outdated belief that ozone is a local, urban problem. In 1991, a National Research Council committee, synthesizing the best available information on ozone formation and transport in the eastern United States, observed that:

> High ozone episodes last from 3–4 days on average, occur as many as 7–10 times a year, and are of large spatial scale: >600,000 km^2. Maximum values of non-urban ozone commonly exceed 90 ppb during these episodes, compared with average daily maximum values of 60 ppb in summer. An urban area need contribute an increment of only 30 ppb over the regional background during a high ozone episode to cause a violation of the National Ambient Air Quality Standard (NAAQS) [120 ppb] in a downwind area. . . . Given the regional nature of the ozone problem in the eastern United States, a regional model is needed to develop control strategies for individual urban areas. (National Research Council. 1991. Rethinking the ozone problem in urban and regional air pollution. National Academy Press. Washington, DC. pp. 105–106).

In recognition of the need for regional controls, the NESCAUM States have urged EPA to develop and implement national control programs such as those currently proposed to address ozone precursor emissions from heavy duty diesel engines, consumer and commercial products (e.g., Architectural and Industrial Manufacturing Rules), standards on locomotive engines, rules affecting heavy duty highway and off-road vehicles, and controls including utility controls which may arise out of conclusions from the work of the Ozone Transport Assessment Group (OTAG). Our efforts to adopt effective reduction strategies will be greatly enhanced by having a standards regime that correctly reflects the physical reality of ozone formation. For a fuller discussion of the regional nature of our ozone problem see the attached report entitled "The Long-Range Transport of Ozone and Its Precursors in the Eastern United States."

PARTICULATE MATTER STANDARD

The NESCAUM States also believe that the regional nature of fine particulate matter will be effectively addressed by the proposed annual fine particulate matter standard. Based on our review of the available science, the levels proposed by EPA

should motivate substantial reductions in regional levels of $PM_{2.5}$ and provide protection against high pollution concentrations that may occur on a day to day basis. The epidemiological evidence is extremely compelling and indicates that the existing particulate matter standard (PM_{10}) is not sufficient to protect people from a range of serious health effects associated with fine particulate matter. Cumulative long-term exposures to high pollution concentrations are of great concern, and the proposed annual $PM_{2.5}$ standard will provide protection against these high levels. This annual standard is likely to be especially important in the NESCAUM region since there appears to be a significant regional problem in which long-range pollution transport, particularly of sulfates, nitrates, and organic aerosols, and soot plays a major role. It should be noted that the Northeast States recommended a tighter daily standard in previous testimony (in Philadelphia, PA, July 25, 1996), and we have asked EPA to closely examine the daily standard to ensure that it adequately protects against exposure to local "hotspots".

CONCLUSION

We believe that implementation of revised standards can result in more rational, equitable, and effective emission reduction strategies. Moreover, by integrating the implementation of the ozone and particulate matter standards, we believe that EPA and the States will achieve important public health improvements using the most cost-effective and flexible means available.

Thank you, again, for this opportunity to present the Northeast States' support of EPA's proposed ozone and PM standards.

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
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WILLIAM F. WELD
Governor

ARGEO PAUL CELLUCCI
Lt. Governor

TRUDY COXE
Secretary

DAVID B. STRUHS
Commissioner

March 11, 1997

Office of Air and Radiation Docket and Information Center (6102)
Attention Dockets Number A-95-38, A-95-54, A-95-58 and A-96-51
US Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

RE: Comments in response to the proposed revision to the National Ambient Air Quality Standards for Ozone (Docket A-95-58) and Particulate Matter (Docket A-95-54), Implementation of New or Revised ozone and PM NAAQS (the Interim Implementation Plan or IIP, Docket A-95-38), and Proposed Requirements for Designation of Reference and Equivalent methods for PM and Ambient Air Quality Surveillance for PM (Docket A-96-51)

Dear EPA Docket Representative:

The Massachusetts Department of Environmental Protection (DEP) is pleased to submit these comments to the US Environmental Protection Agency (EPA) in support of the proposals listed above. The Massachusetts DEP supports EPA's actions to establish effective ozone and particulate matter (PM) standards. We believe EPA has acted correctly and appropriately by proposing an 8-hour ozone standard and developing a standard for fine particulate matter (PM-fine). The documentation and health studies reviewed by EPA and the Clean Air Science Advisory Board point to the need to revise the ozone and PM standards because the current standards are not sufficiently protective of public health. The health of the citizens of the Commonwealth and all Americans is our priority, and they will benefit from these revisions.

As you know, Massachusetts Secretary for Environmental Affairs Trudy Coxe has voiced her strong support for EPA's proposals and, in particular, cited two reasons why Massachusetts felt it was critical that EPA press forward with these revisions:

Massachusetts is affected significantly by transported air pollution of PM-fine and ozone Massachusetts has worked hard to try to attain the current standard for ozone, and we will continue to do so, by working collaboratively with the Northeast States for Coordinated Air Use Management (NESCAUM) states, the Ozone Transport Commission (OTC) states and in the Ozone Transport Assessment Group (OTAG) process. However, as EPA acknowledges, and recent work at OTAG has clearly shown, Massachusetts and New England, are affected by transported air pollution coming from along, and outside, the Northeast corridor.

Revising the health standards should require controls in upwind areas, and will therefore reduce transport of ozone and ozone precursors into Massachusetts and the Northeast. EPA must ensure that these new standards reduce the impact of transport on Massachusetts and New England. We believe a number of provisions in the Interim Implementation Plan (IIP) and ozone standard revision (i.e., changing to an 8 hour standard) will help focus on longer term episodes that, are in part, a result of transport. Still, we insist that EPA continue to move emission reductions strategies for nitrogen oxides and hydrocarbons forward, and reduce transport as soon as possible.

The cost of compliance must be considered *after* the standards are established
With these proposals, EPA acted as required by the Clean Air Act (CAA) and met their responsibility to propose standards that protect public health. Many interests who will be affected by these standards have come forward to protest that they will cost too much, and will not be balanced by resulting improvements in public health. We disagree. And as required, the cost of implementing standards is to be considered after the standards are promulgated, not before. There is ample evidence that the cost of compliance can be as much as an order of magnitude less than the affected industries will argue up front. Two examples are particularly relevant - the results of the trading program required under the Acid Rain Title of the CAA, as well as Massachusetts's own emission trading program, and the costs Massachusetts realized in implementing California's car standards. In both cases, the costs projected by industry were high by more than a factor of 10.

Public Health is Our Priority
DEP's Office of Research and Science reviewed the scientific basis used by EPA and CASAC to develop these standards. We concluded that EPA has done a commendable job in reviewing and analyzing the available data on PM and ozone, and revising the standards to reflect the current state of the science on the toxicity of these pollutants. The proposed changes in the ozone and PM standards are supported by current scientific data on the health effects of these agents.

In addition, DEP supports the alternative rounding convention proposed by EPA for the 8-hour ozone standard. The rounding convention in the proposal would, in effect, lead to implementation of a standard at 0.085 ppm. DEP supports an 0.80 ppm standard, averaged over 8 hours, and believes EPA should implement the standard as such. The revision to an 8-hour standard is a major improvement over the current 1-hour standard, and should reduce health risks compared to the current standard. EPA must be vigilant in continuing to review the chronic effects of ozone and determining whether the standard continues to ensure an "adequate margin of safety" or, should be strengthened further during the next national ambient air quality standard (NAAQS) review for ozone.

The proposed revision to the PM standard is appropriate within the requirements for the NAAQS standard setting and well supported by numerous epidemiological studies. In addition, we commend EPA for recognizing the need for further research on the characterization of PM-fine and the mechanism of toxicity of fine particulate matter.

DEP has worked closely with the other NESCAUM states to review the interim implementation policy and the monitoring requirements for PM and ozone. We urge you to review NESCAUM's comments closely, for they reflect the combined opinion of eight northeast states, all affected by transport, and support EPA.

Resources to implement the new standards will be crucial

EPA's proposed new standards for ozone and PM-fine will require major new investments by state and local agencies in monitoring and planning efforts. We urge EPA to work closely with the states and the State and Territorial Air Pollution Program Administrators (STAPPA) to develop the information on the types of resources that states will need for these efforts. In addition, EPA must work with states and Congress to ensure that states are provided adequate funding levels to meet new monitoring requirements and provide the data needed to assess and address the areas where public health is threatened. Our monitoring and assessment of the PM-fine problem must begin as quickly as possible.

States will also need to participate in regional planning efforts that are being envisioned by EPA's Federal Advisory Committee on the new standards. We have been devoting a large amount of resources to participating in the OTAG and FACA efforts, and envision a similar level of effort for implementing the ozone and PM standards when they are in place. While these efforts will require considerable resources on our part, we believe they are critical to ensuring cost-effective and equitable implementation of the new standards. In addition, EPA must ensure that once plans are developed that states move forward to implement the controls and strategies recommended.

Spatial Averaging of PM data should be Removed
The monitoring method and strategy EPA has proposed for PM-fine is extremely ambitious. DEP believes that state and local agencies need to undertake this effort seriously and as soon as possible. However, we were puzzled by EPA's provision to require spatial averaging of PM monitors. It is not clear what additional benefit will result from this requirement and we believe it will lead to unnecessary confusion and uncertainty in our monitoring regime. We also believe it will very difficult to explain to the public, and inequitable, since areas that may violate the standard but for the provision allowing spatial averaging, will question our rationale for averaging and allowing them to remain at risk. If exposure to PM-fine is a threat to public health, and if an area is shown to violate the standard, then the threat should be reduced. EPA should not allow an area to "average out" of the problem using levels measured below the standard at other monitors. We urge EPA to drop this part of the proposal.

"No backsliding" must be real
We believe that EPA is correct to ensure that emission reduction strategies in place, or going into place to meet the current ozone and PM standards, must remain in place. And, additional reductions should continue to occur as progress towards attainment (meeting reasonable further progress as required by the CAA) - this would ensure "no backsliding". However, we are concerned that areas that have received NOx waivers, and are currently exempt from many CAA requirements, and areas that may be required to implement reductions based on the OTAG process, will continue to be allowed to "backslide", while other areas are required to continue to implement reductions at a steady rate. The IIP should be revised to require all states who receive state implementation plan (SIP) calls as a result of OTAG (under the current standards) meet rate of progress requirements and progress towards attainment before their SIP for a new standard is put in place. Also, any reductions that must occur as a result of the OTAG process should be in place as soon as practicable so the burden for achieving emission reductions is shared across the country. In addition, EPA must review the status of NOx waivers in all areas, once recommendations from OTAG are finalized.

Joint Implementation is Effective
Finally, we support EPA's intention to implement the revised ozone and new PM standards jointly. Many of the same sources contribute to PM-fine and ozone levels, and to transport of both pollutants. In addition, precursors pollutants for both standards cause environmental problems year-round, including effects on ecosystems, as well as public health. For example, NOx emissions contribute to adverse impacts on the environment with acid rain, and nitric acid deposition, and NOx emissions are associated with many other environmental problems, including eutrophicaton of coastal waters and estuaries, and decreased visibility. Incentives and mechanisms to implement control strategies that would be effective to control ozone and PM-fine precursors are critical. We believe there are many such measures, and that for too

long, states and EPA have considered air pollution problems in isolation, when in fact, many of the precursors and control strategies can be used to reduce multiple pollutants, at lower overall cost.

Again, we support EPA's efforts to finalize these proposed standards for ozone and PM-fine. We look forward to working with EPA, and within the FACA process, to ensure equitable, successful and cost-effective implementation. Please contact Barbara Kwetz, Director of DEP's Division of Air Quality Control at 617/292-5593, should you have any questions concerning our comments.

Sincerely,

David B. Struhs
Commissioner

enclosure - Secretary Coxe's testimony at EPA's public hearing in January 1997

cc:
Secretary Trudy Coxe
EPA Region I Administrator John DeVillars
Barbara Kwetz, Director, DAQC

HOWARD DEAN, M.D.
Governor

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January 9, 1997

Carol M. Browner
Administrator
United States Environmental Protection Agency
Washington, D.C. 20460

Dear ~~Administrator Browner~~, Carol,

I want to commend the Clinton Administration for its work on revisions to the national ambient air quality standards for ozone and particulate matter. The updating of these standards will be a significant step forward in the protection of the health and well being of not only our nation's citizenry, but of our natural resources as well.

The extensive three year review of scientific and technical assessments of the effects of these pollutants presents a clear case that revisions to the standards are in order. These assessments have withstood the test of rigorous peer review and public comment. Further, they both have been submitted to the scrutiny of the Clean Air Science Advisory Committee, who have recommended that you move forward with revisions to these standards.

While your Agency should be proud of the work completed to reach this point, much work remains to assure these standards are adopted. In this regard, I write to you, not only as a governor, but as a physician and as a parent. As a governor, I look for a rigorous, scientific and objective process that is fair and balanced. As a physician, I expect you to fully evaluate the public health implications of these standards, and to establish standards adequate for national health protection. As a parent, I ask you to be very mindful of one of our most sensitive populations, the children, and to set standards to prevent injury and unhealthy exposures to our youth, for they are our future.

As you know, under the law the test you must use for standard setting is clear. The Administrator must establish primary air quality standards at a level requisite to protect the public health, while allowing an adequate margin of safety. Speaking as governor, physician and parent, I urge you to adhere closely to this statutory mandate and establish standards which protect the public health, based upon the scientific information before you.

Moreover, the weight of the current scientific evidence should compel EPA to set the new standards at the most protective levels.

Sincerely,

Howard Dean, M.D.
Governor

HD/tw

c: John DeVillars
US EPA Docket 95-54

PSE&G

Public Service Electric and Gas Company One Massachusetts Avenue N.W., Suite 710, Washington, D.C. 202/408-0800
Fax: 202/408-0214

28 April 1997

Eric B. Svenson
Manager,
Environmental Strategy & Planning
Public Service Electric & Gas
80 Park Plaza
P.O. Box 570
Newark, New Jersey 07102

Senator Max Baucus
Committee on Environment and Public Works
United States Senate
458 Dirksen Office Building
Washington, D.C. 20510

Dear Senator Baucus:

On behalf of Public Service Electric & Gas Company (PSE&G), I respectfully request that the attached public comments be submitted into the record for the Clean Air, Wetlands, Private Property and Nuclear Safety Subcommittee hearing on April 29. These comments were first submitted to the United States Environmental Protection Agency (EPA) on March 12, 1997. They reflect PSE&G's strong support for EPA's proposed revisions to the national ambient air quality standards NAAQS for ozone and particulate matter.

PSE&G is the nation's fourth largest investor owned utility, providing electric and gas services to over 2.2 million customers in a densely populated service territory that is home to more than 5.5 million people. In 1992, PSE&G committed itself to reducing its emissions of oxides of nitrogen (NOx) by 80 percent by the year 2000. Since that commitment was made, our NOx emissions have dropped by nearly 70 percent.

Our experience in reducing our own air emissions, combined with expectations of the people we serve, convinces us that EPA's proposed revisions to the NAAQS for ozone and particulate matter are both necessary and achievable. Were other electric utilities to match our commitment to substantial NOx reductions, much of the air quality problems identified by these revised standards would be solved cost-effectively.

Thank you for including our comments in the record of your hearing. Please feel free to contact us should you have any questions or concerns regarding our position on this matter.

Sincerely,

Eric

Eric B. Svenson

Attachment

Comments of

Public Service Electric and Gas Company
Newark, New Jersey

on

Proposed Revision and Implementation of the National Ambient Air Quality Standards for Ozone and Particulate Matter

United States Environmental Protection Agency

Docket # A-95-58
Docket # A-95-54
Docket # A-95-38

March 12, 1997

Public Service Electric and Gas Company (PSE&G) is pleased to submit these comments in support of the United States Environmental Protection Agency's (EPA) proposals to revise the national ambient air quality standard (NAAQS) for ozone and particulate matter. In addition, PSE&G welcomes the opportunity to provide EPA with comments on the implementation of these revised public health standards.

PSE&G is the nation's fourth largest investor owned utility, providing electric and gas services to over 2.2 million customers in a densely populated service territory that is home to more than 5.5 million people. The people we serve demand a healthy environment. So do we. In 1992, PSE&G committed itself to reducing its emissions of oxides of nitrogen (NOx) by 80 percent by the year 2000. Since that commitment was made, our NOx emission have dropped by nearly 70 percent.

Our experience in reducing our own air emissions, combined with expectations of the people we serve, convinces us that EPA's proposed revisions to the NAAQS for ozone and particulate matter are both necessary and achievable. This conclusion is reflected in the following five points:

- PSE&G believes that the revised ozone standard better reflects the nature and extent of the ozone problem confronting the eastern half of the United States. The revised standard provides a more stable measure of ozone concentrations over time and more accurately characterizes ozone as a chronic, regional public health problem.

- PSE&G believes that the weight of scientific evidence supports revision of the particulate matter standard to include a public health standard for fine particulate matter.

- PSE&G supports the time-honored principle of the Clean Air Act that public health is the only criteria to be used in establishing federal air quality standards. While we have concerns about the costs associated with meeting public health standards, we believe that these concerns can be addressed through implementation strategies that focus on cost-effectiveness, flexibility, and market incentives for innovative approaches.

- PSE&G believes that a combination of local and regional strategies will be required to achieve the public health standard for ozone and particulate matter in all areas of the country. Many of these strategies are already being implemented as a result of the 1990 Clean Air Act amendments. Implementation of these measures should continue.

- PSE&G believes that there are cost effective regional strategies currently available to substantially reduce area-wide concentrations and transport of ozone, fine particulates, and their precursor pollutants. When combined with existing Clean Air Act measures, these regional strategies will go a long way toward meeting the proposed federal health standards for ozone and particulate matter.

The remainder of this document discusses each of these five points in more detail.

The Revised Ozone Standard Better Reflects The Nature And Extent Of The Ozone Problem Confronting The Eastern Half Of The United States.

Ozone's affect on human health has been studied thoroughly for more than twenty years. The resulting body of evidence points to significant associations between ozone and a wide range of health effects. Short term ambient exposures to ozone have been associated with decreases in lung function, aggravation of pre-existing respiratory disease, increases in daily hospital admissions and emergency department visits for respiratory causes, and increased mortality. Populations affected by high ambient concentrations of ozone include healthy individuals who work or exercise vigorously outdoors during periods of high ozone concentrations. These studies show that children, senior citizens, and any person suffering from asthma are at particular risk.

Since EPA's last review of the ozone standard in 1979, over three thousand new studies have been published on the health and ecological effects of ozone. These studies have identified several health effects associated with longer exposure periods for which the current standard does not provide adequate protection.

Much of the research cited in EPA's staff paper on the revised ozone standard suggests that the effects of six to eight hour exposures at moderate levels of exertion are

of greater concern than the effects of one hour exposures at heavy exertion. Further, the literature indicates that repeated exposure to ozone can cause increased susceptibility to respiratory infection and can aggravate preexisting respiratory diseases, such as asthma. Additionally, this work indicates that long-term exposure to ozone can impair the lung's defense mechanisms and cause irreversible changes in lung structure. Finally, the literature suggests that adverse health effects occur at ozone levels far below the level set under the current health standard. Taken as a whole, ozone research of the past decade has created a body of evidence that makes the current one hour standard of 120 parts per billion (ppb) difficult to defend.

Moreover, the Clean Air Scientific Advisory Committee (CASAC) - an independent panel of scientists from academia and industry created by Congress - has issued a powerful and credible endorsement of Agency action. Upon review of the relevant science, CASAC unanimously agreed that the 1-hour ozone standard should be replaced with an 8-hour standard. Furthermore, CASAC formally recognized that adverse health effects associated with ozone exposure may be experienced down to levels of ozone naturally occurring in the environment. Given the weight of scientific evidence, and CASAC's conclusion, EPA's decision to revise the current standard seems justified.

Revision of the public health standard for ozone makes good science. It also makes good policy. A report on the long range transport of ozone and its precursors recently released by the Northeast States for Coordinated Air Use Management (NESCAUM) concludes that much of the midwestern United States acts as an "ozone reservoir." This reservoir is repeatedly "drained" by prevailing west winds, significantly contributing to high ozone concentrations in the northeastern United States. The report notes that ozone levels in this midwestern ozone reservoir often reach 80 to 90 ppb, below the current health threshold for ozone but above the proposed revised standard.

PSE&G believes that resolution of the ozone transport issue is critical if New Jersey and other areas of the northeastern United States are ever able to achieve either the existing or proposed public health standard for ozone. When laid over the data presented in the NESCAUM report, the revised ozone standard tell us that much of the eastern half of the United States shares this problem.

The Weight Of Scientific Evidence Supports Revision Of The Particulate Matter Standard To Include A Public Health Standard For Fine Particulate Matter.

Many scientists and experts on the health ramifications from air pollution have testified and commented on the legitimacy of the science used by EPA to make the recommendations on revising the public health standard for particulate matter. PSE&G has no additional information to add to this debate. Our support of the revised standard for particulate matter is based upon all that we have read and heard in the last several months.

Exposures to particulate matter have been studied in 51 cities over the past ten years. These studies have measured the health effects in millions of people. The cause-effect relationship between particulate matter emissions and human health is clear. After review of all available data, the CASAC unanimously agreed that there is adequate scientific basis for retaining the standards for PM-10, while 19 of the 21 committee members supported the move toward an additional PM-2.5 standard.

While EPA acknowledges that the precise link between PM 2.5 and observed adverse health effects has yet to be established, the standard-setting process does not require that the mechanism be understood. The process only requires that the cause-effect relationship be adequately demonstrated. This demonstration is the basis for EPA's decision, and there is precedent to support proceeding on the basis of such a demonstration. EPA did not wait to require reductions of lead in gasoline, even though the physiological mechanisms were not well understood. Likewise, a precise understanding of the mechanisms associated with asbestos exposure was also not completely documented prior to regulatory action.

We are aware that the epidemiological studies on particulate matter need to interpreted cautiously, and we understand that much more research needs to be done fully understand the relationship between fine particulates and documented health effects. However, given the weight of scientific evidence and past precedent, we believe that EPA has a sufficient basis to act.

Public Health Is The Only Criteria To Be Used In Establishing Federal Air Quality Standards.

PSE&G supports the time-honored principle of the Clean Air Act that public health is the only criteria to be used in establishing federal air quality standards. We take this position for two reasons.

First, Congress was right to prohibit the consideration of costs when EPA sets health-based air quality standards. Citizens must have confidence that science, rather than economics, drives public policy on health. While cost is an integral issue in the implementation of standards, it cannot be allowed to influence the setting of those standards.

Second, experience should make EPA wary of frightening estimates of compliance costs associated with the revised standards. The actual cost of implementing the Acid Rain program is less than 10% of the estimates offered by the electric utility industry and others during the debate over reducing sulfur dioxide (SO2) emissions. While it is fair to say that much of the savings was through implementation of a national air emission trading program, it is not inconceivable that Congress and EPA were fed inflated cost estimates by those parties reluctant to do anything to improve air quality.

PSE&G has a strong commitment to the environment, but we also have an obligation to return a profit to our shareholders. We do not see our environmental goals in conflict with our economic goals. Major air pollutants have decreased nationally by 30 percent since the original Clean Air Act of 1970. During that same period of time, our national gross domestic product has increased almost 100 percent. These results over a 25-year period prove that a national effort and goal for clean air can co-exist with healthy and robust economic growth.

While we have concerns about the costs associated with meeting public health standards, we believe that these concerns can be addressed through implementation strategies that focus on cost-effectiveness, flexibility, and market incentives for innovative approaches. PSE&G has a long standing commitment to air emission trading and has been a leader in creating, using, and trading discrete emission reduction credits. Our efforts have resulted in several thousands of tons of oxides of nitrogen (NOx) reduced while facilitating cost effective compliance for sources that would otherwise have received administrative waivers from compliance with existing air quality regulation. Through practical experience, PSE&G has learned that trading can be an important tool for encouraging emission reductions, reducing costs, and providing flexibility with benefits to the environment beyond what can be achieved through traditional command and control regulations.

A Combination Of Local And Regional Strategies Will Be Required To Achieve The Public Health Standard For Ozone And Particulate Matter In All Areas Of The Country.

Together with other New Jersey industries, PSE&G has made substantial investments in control technologies and process changes to reduce air pollution. These local efforts at reducing air pollution have resulted in substantial improvements in New Jersey's air quality. New Jersey industry is justifiable proud of these accomplishments.

Local air pollution control strategies will continue to be an important component of New Jersey's efforts to achieve and maintain public health standards for ozone and particulate matter. However, PSE&G recognizes that many measures required by the 1990 Clean Air Act have yet to be implemented on either the state or federal level. It is our expectation that existing mandatory measures, if fully implemented, will play an important role in improving air quality in the years ahead.

Unfortunately, despite the progress being made, New Jersey's local control efforts are compromised by pollution carried into New Jersey by prevailing winds from the South and Midwest. Data from the Ozone Transport Assessment Group (OTAG) process, the North American Research Strategy for Tropospheric Ozone (NARSTO)-Northeast project, and the recent NESCAUM report on ozone transport all confirm the role that transport plays in the persistent air quality problems in the Northeast. As areas that meet the current public health standards for ozone and particulate matter find themselves with

air quality problems under the new standards, the case for a comprehensive regional strategy to improve air quality becomes compelling.

PSE&G Believes That There Are Cost Effective Regional Strategies Currently Available To Substantially Reduce Area-Wide Concentrations And Transport Of Ozone, Fine Particulates, And Their Precursor Pollutants.

OTAG data, the NARSTO-Northeast project, and the NESCAUM report on ozone transport substantiate the problem of pollution transport across the eastern half of the United States. At the same time, these efforts demonstrate the value, and cost effectiveness of substantial NOx reductions from large stationary in reducing regional concentrations of ozone. Additionally, EPA data and the emission inventory compiled by OTAG confirms the fact that electric power producers are the largest single source of NOx among all industries in the eastern half of the United States.

While scientific research is pointing to the need for regional NOx reductions, deregulation of the electric utility threatens an increase in regional NOx emissions. In its environmental impact statement on wholesale deregulation, the Federal Energy Regulatory Commission acknowledged that federal deregulation efforts were likely to result in a 33 percent increase in the utilization of older, high emitting coal power plants in the South and Midwest. Economic deregulation of the utility industry will exacerbate the ozone transport pollution problem unless both issues are dealt with simultaneously.

An obvious solution is the implementation of a regional program to limit NOx emissions from power producers. PSE&G believes that a regional cap on power producer NOx emissions, on the order of less than one million tons per ozone season, is necessary to address the problem of ozone transport throughout the eastern half of the United States. When coupled with local measures currently required under the Clean Air Act, this regional NOx cap should be set to produce a sufficient amount of NOx reductions to enable all areas within the eastern half of the United States to demonstrate attainment with the revised ozone NAAQS. Implemented through an emission trading program built around an output-based generation performance standard, this cap would place all forms of electric generation on an equal environmental footing, simultaneously addressing the problem of increased emissions due to electric industry restructuring. Running in tandem with the SO2 reductions associated with the Acid Rain program, this strategy will also have a beneficial effect in reducing the formation of fine particulates in the atmosphere.

A regional cap on electric power NOx emissions, coupled with a generation performance-based trading system, presents EPA with an opportunity to improve the economy and the environment. PSE&G urges EPA to seize this opportunity in the months ahead.

Respectfully Submitted

Mark S. Brownstein, Esq.
Environmental Policy Manager

STATEMENT OF THE UNITED STEELWORKERS OF AMERICA, AFL–CIO.CLC

The United Steelworkers of America represents 540,000 workers in the United States. Our ranks also include 281,000 retired American members. Most of our members work in the steel, rubber, chemical, mining, nonferrous metals, and general manufacturing industries which are major contributors to particulate and ozone pollution. They live in the urban and industrial areas most affected by particulates and ozone. Their families have much to gain from properly considered regulations which reduce the risk of dirty air—and much to lose should poorly crafted ones cause serious economic dislocation in our major extractive and manufacturing industries. We take a keen interest in this rulemaking.

1. THE PROPOSED STANDARDS

The USWA supports EPA's proposals for $PM_{2.5}$ and ozone. Under the Clean Air Act, the primary air quality standards must be based on health considerations alone. The evidence currently in the record is more than sufficient to establish the need for strengthening the NAAQS for ozone, for adding a new standard for fine particulates, and for modifying the averaging methods for determining compliance.

In developing the proposals, the EPA staff considered more than 5,000 scientific studies and medical reports. This review was the most extensive EPA has ever conducted for public health standards. The two largest studies—the Harvard six-city study and the American Cancer Society study—found increased mortality at particulate levels well below the current standards. Other, smaller studies were consistent with these findings. EPA estimates that the particulate standard alone will prevent 20,000 premature deaths per year; the Natural Resources Defense Council estimates 64,000 deaths per year from fine particulate pollution. The evidence suggests that the excess mortality primarily is due to fine particulates, less than 2.5 micrometers in diameter. The studies also show a strong link between ground-level ozone and decreased lung function, increased asthma, and more severe respiratory infections. Fine particulates and ozone disproportionately affect children and the elderly.

Taken as a whole, the studies are compelling. We believe that EPA has clearly demonstrated that the new $PM_{2.5}$ standard and the revised ozone standard are necessary to protect public health.

EPA has also proposed a change in the averaging method for the current PM_{10} standard, to one based on the 98th percentile of the distribution of monitored concentrations at the highest monitor. It has been charged that this method is less stringent than the current method based on one allowed exceedance per year. However, the proposed statistical method gives a much fuller picture of the actual situation, and will result in a more realistic determination of the need for additional controls. We support the change.

2. ADDITIONAL RESEARCH

EPA's proposals are well supported by the current evidence. However, additional research is essential. We do not yet know the ambient levels of $PM_{2.5}$ in most parts of the country. We do not have a clear picture of how the sources and the components of $PM_{2.5}$ vary by region. We do not have a sufficient understanding of how existing programs aimed at PM_{10} affect ambient concentrations of $PM_{2.5}$. These issues are critical to the intelligent design of control strategies. Direct, government-funded research into process-specific control technology would also help industry meet the new standards.

Further research might also help us refine the standards themselves. It is possible that $PM_{2.5}$ is not the best particulate fraction on which to concentrate. It has also been suggested that most of the health risk is caused by particular species within $PM_{2.5}$, such as acid aerosols or reactive metals.

For these reasons, EPA, in cooperation with the National Institute for Environmental Health Sciences, should commit to an aggressive program of research. The program should not be used to delay implementation of the revised standards; however EPA should be willing to modify those standards should the research so indicate.

3. IMPLEMENTATION

The USWA is grateful for EPA's willingness to add us to the Subcommittee for the Development of Ozone, Particulate Matter and Regional Haze Implementation Programs. Although the Subcommittee is already very large, we hope it will be open to other labor organizations who may wish to join. Plant workers, acting through their unions, have much to contribute to a discussion of effective controls.

National ambient air quality standards are based on health considerations alone. This puts a special burden on those who must devise strategies for meeting the standards. Public health will not be protected by implementation strategies which clean the air only at the cost of massive economic dislocation.

Economics becomes important in the next phase of this effort, as we explore different control options. Unfortunately, EPA's economic analysis usually focuses on the overall cost of a regulation to the affected industries or to the economy as a whole. We believe that employment is a much more important consideration. Employment and income are strongly correlated to health. Other economic variables are not. EPA should work toward compliance methods which protect, and if possible increase, the level and quality of employment.

While the current phase of rulemaking is concerned only with health risks, much of the public debate has centered around a supposed conflict between jobs and environment. Our experience teaches a different lesson. Improving the environment usually creates jobs. Some of our members make pollution control equipment. Others make the steel, aluminum, rubber, plastic and glass that goes into it. Others design, install, operate and maintain the equipment. An increasing number of jobs in our union, and in the workforce generally, depend on environmental protection. Of course, it is possible to devise control strategies that really do destroy jobs, but that need not happen. Protecting the environment while protecting jobs will take careful planning, and the cooperative efforts of industry, labor, government at all levels, and the environmental community—but it is possible, and it is essential. EPA should do all it can to facilitate the process.

CLEAN AIR ACT: OZONE AND PARTICULATE MATTER STANDARDS

THURSDAY, JULY 24, 1997

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON CLEAN AIR, WETLANDS,
PRIVATE PROPERTY, AND NUCLEAR SAFETY,
Washington, DC.

IMPLEMENTATION STRATEGY

The subcommittee met, pursuant to notice, at 10:56 a.m. in room 406, Dirksen Senate Office Building, Hon. James Inhofe (chairman of the subcommittee) presiding.

Present: Senators Inhofe, Thomas, Hutchinson, Graham, Allard, and Sessions.

OPENING STATEMENT OF HON. JAMES M. INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

Senator INHOFE. The subcommittee will come to order.

The purpose of today's hearing is to examine the EPA's implementation plan for the new ambient air quality standards for ozone and particulate matter, and I want to emphasize the word "plan" because what the EPA is planning today is not necessarily what will happen tomorrow. I don't think their plan is based on reality and, therefore, will not happen.

First, from what I read the EPA is rewriting the Clean Air Act and their plan is outside of congressional authority. Congress has not given authority to the EPA to do the following: a cap and trade program for utility emissions. I understand that, of course, we do have the cap and trade program in other areas, such as acid rain. But it is my position that we do not have it in this case.

Second, to maintain two different ozone standards at the same time. This is somewhat controversial. But it's my understanding that they will be attempting to maintain the ozone standards at .12 in some areas, and at the same time .08 in other areas.

Third, a transitional reclassification system.

It's my feeling and my interpretation that the authority is only there for attainment or nonattainment. These are just some examples of areas where I believe the EPA is trying to exceed their legal and congressional authority. Because they lack authority, they open themselves up to numerous possible lawsuits by States and regulated community and private citizens' suits. They have already been sued under SBREFA, the Small Business Regulatory Enforcement Act. The result of these suits will be a court implementation

plan which ignores the flexibility in safeguards the EPA is promising, and which makes those flexibility promises meaningless.

To understand this one only has to look at the past history of the Agency. As Senator Santorum said in Tuesday's Ag hearing, the EPA talks about flexibility, but never delivers. You only have to look at recent EPA threats in Pennsylvania and Virginia to see that "flexibility" to their mind means "EPA mandates." Furthermore, whenever EPA talks about flexibility implementation, or stretching out requirements, they are quickly sued by radical environmental groups, and then the Agency is quick to roll over and enter into binding consent agreements.

It is important to note that this frustration is felt not only in Congress, but more so in the States and communities. I received a letter this week from the heads of 13 State environmental agencies calling for congressional intervention to stop these standards because of scientific uncertainties, lack of clear benefits, and questions surrounding the implementation. I would like to enter this letter into the record, and point out to my colleagues on this subcommittee that the States which signed these letters include Oklahoma, Idaho, Alabama, Virginia, and Montana, with all of these States being represented on this committee.

The only witness at today's hearing is Mary Nichols, the Assistant Administrator for Clean Air at the EPA. I understand that Ms. Nichols will be leaving the EPA in Washington, DC shortly to return to California. Because of this I thought it would be important to hear how Ms. Nichols believes this will be implemented since all of the planning has occurred under her watch. If and when this is ever fully implemented it is important that a record be built which codifies the EPA's promises.

Ms. Nichols, I will say to you that while we have had differences in the past, and we continue to have differences, I think when you get out to California you will have some different views on some of these things, and we'd be more in agreement, and I've always enjoyed working with you.

I'll look forward to hearing now from Ms. Nichols.

[The prepared statement of Senator Inhofe follows:]

PREPARED STATEMENT OF JAMES INHOFE, U.S. SENATOR FROM THE STATE OF OKLAHOMA

The hearing will now come to order. The purpose of today's hearing is to examine the EPA's implementation plan for the new National Ambient Air Quality Standards for ozone and particulate matter. I want to emphasize the word plan, because what the EPA is planning today is not necessarily what will happen tomorrow. I do not think their plan is based on reality and therefore will not happen.

First, from what I read, the EPA is rewriting the Clean Air Act and their plan is outside of Congressional authority. Congress has not given authority to the EPA for the following:

- A Cap and Trade program for utility emissions.
- To maintain two different ozone standards at the same time.
- A transitional classification system.

These are just a few examples of areas where I believe EPA is trying to exceed their legal and Congressional authority.

Because they lack authority, they open themselves up to numerous possible lawsuits by States, the regulated community, and private citizen suits. They have already been sued under SBREFA. The result of these suits will be a court directed implementation plan which ignores the "flexibility" and safeguards the EPA is promising and which makes those flexibility promises meaningless. To understand this one only has to look at the past history of the Agency. As Senator Santorum

pointed out in Tuesday's Agriculture hearing, the EPA talks about flexibility but never delivers. You only have to look at recent EPA threats in Pennsylvania and Virginia to see that flexibility to their mind means EPA mandates. Furthermore, whenever EPA talks about flexible implementation or stretching out requirements they are quickly sued by radical environmental groups and the Agency is quick to roll over and enter into binding consent agreements.

It is important to note that this frustration is felt not only in Congress, but more so in the States and communities. I received a letter this week from the heads of thirteen State environmental agencies calling for Congressional intervention to stop these standards because of the scientific uncertainties, lack of clear benefits, and questions surrounding the implementation. I would like to enter this letter into the record and point out to my colleagues on the Committee that the States which signed included Oklahoma, Idaho, Alabama, Virginia, and Montana, with all of these States being represented on this Committee.

The only witness at today's hearing is Mary Nichols, the Assistant Administrator for Air at the EPA. I understand that Ms. Nichols will be leaving the EPA and Washington, DC. shortly to return to California. Because of this I thought it was important to hear how Ms. Nichols believes this will be implemented since all of the planning has occurred under her watch. If and when this is ever fully implemented it is important that a record be built which codifies the EPA's promises.

I look forward to hearing how Ms. Nichols believes this will be implemented and I wish her luck in her future endeavors.

Senator INHOFE. I see that the ranking minority is here, Senator Graham. First of all, I think you want to get on record voting on the nomination, the Clark nomination.

Senator GRAHAM. Yes, Mr. Chairman. Thank you, and I have done so with our committee staff. I might have an opening statement to file. I thank you for convening this hearing and look forward to receiving the testimony of the witnesses.

Senator INHOFE. Thank you, Senator Graham.

I've been informed by the staff that you probably should be on record with your vote on S. 399, the McCain bill, and then S. 1000 and S. 1043. These are naming bills you are familiar with.

Senator GRAHAM. I would like to be recorded aye on all those.

Senator INHOFE. Thank you, sir.

Senator Thomas.

OPENING STATEMENT OF HON. CRAIG THOMAS, U.S. SENATOR FROM THE STATE OF WYOMING

Senator THOMAS. Thank you, Mr. Chairman. Thank you for holding this hearing, to discuss ozone and particulate matters, standards promulgated by EPA.

Since EPA released the proposed regulations in November, this committee has held numerous hearings regarding this matter, and heard concerns of many of the Nation's Governors, State, county and local officials and the business community. Furthermore, we've heard from the scientists on EPA's own Clean Air Scientific Advisory Committee, heard them testify there's no bright line, and that they need more time to conduct additional research into PM and ozone. Unfortunately EPA and the Administration have refused to listen.

President Clinton endorsed EPA's standards in spite of public opposition from more than 250 Members of Congress, 27 Governors, labor unions and many small businesses throughout the country. These standards could end up being the most expensive in history, and severely limiting economic growth. With so many areas of the country having problems meeting current environmental standards, these regulations could throw new counties into nonattainment.

Additionally, these counties currently in nonattainment will probably never reach compliance.

It's my understanding that Administrator Browner has been meeting with Members of Congress and various industries, telling them not to worry about the new rules because they won't affect their interests. Most recently she informed the agricultural community of that when she testified before the Ag Committee earlier this week, Mr. Chairman. It seems that EPA's really doing some soft-pedaling on the impacts of the new air quality rules and, in fact, perhaps distorting the facts. I'm interested in Ms. Nichols telling us how EPA can guarantee these promises when they don't even know what the 50 States will end up regulating.

I've always had strong reservations about EPA's regulations and do not believe that Congress will back them. The chairman of this subcommittee has done an outstanding job on this issue, and I intend to help him in any way I can. I do support additional research and was pleased the Senate passed the EPA-HUD and the Independent Agencies appropriation, which included funding for $PM_{2.5}$ research. It's my intention to work with the Appropriations Committee in guiding that on through.

So, Mr. Chairman, I'm anxious also to hear what Ms. Nichols has to say about the real implementation strategy. It may change tomorrow, but it is our duty to exercise oversight and determine if the EPA has legal authority to do the things it claims it will do, and I appreciate your having the hearing. Thank you.

Senator INHOFE. Thank you, Senator Thomas.

Senator Hutchinson.

OPENING STATEMENT OF HON. TIM HUTCHINSON, U.S. SENATOR FROM THE STATE OF ARKANSAS

Senator HUTCHINSON. Thank you, Mr. Chairman.

Ms. Nichols, I also want to join in the chorus wishing you the best in California, and your new endeavors out there. Thank you for coming today, and Mr. Chairman, thank you for taking such an active role on these proposed air standards, and the hearings that we've now had. As I've said repeatedly, it seems out of those hearings that one thing was clear—there's an awful lot that is unclear; there's a lot of difference among scientists. That is why I have the position that it is far better for us to seek more data, have more time before we implement standards that are going to have such a dramatic impact.

Arkansas is a rural, primarily agricultural State. It is growing, but it currently has a relatively small amount of heavy industry and a relatively small population, two and a half million. Now, that is exactly the type of State that one would think was going to be minimally impacted by EPA standards on ozone and particulates. Unfortunately, that's just not the case. It is already anticipated that several counties in eastern Arkansas are going to be out of attainment under these new standards. One county, Crittenden County, is already out of attainment for ozone and, as the Mayor of west Memphis, AR said, would be out of attainment even if the entire city was plowed up and used for farmland. With Memphis so close, right across the river, there's just very little that west Memphis can do to achieve air quality under the guidelines of the

EPA. Other counties, such as Arkansas County and Ashley County, are almost exclusively agricultural in nature.

Ms. Browner testified before the Agriculture Committee on Tuesday, and has repeatedly asserted, that agriculture would not be affected by these new standards. And she would assure through Secretary Glickman that that would not be the case. The reductions could be achieved and attainment realized by going after big power plants. Well, that's fine, except that in Arkansas and Ashley Counties they don't have any power plants. It's all agricultural. One county that does have a power plant is Jefferson County, where Pine Bluff is, just to the west of Arkansas County, but according to EPA's own documents they will "not" be out of attainment. But to me that creates an interesting paradox, how you get two counties that are agricultural that are out of attainment with no power plant. You have Jefferson County, with a power plant, that's going to be in attainment. If you go after the power plant you are not going to solve the problem of the two agricultural counties.

So I think agriculture is going to take a beating in the United States over the next few years between what the EPA wants to do with ozone and particulates, and what the Administration is saying they want to do in relation to global climate and the effects on an agricultural State like Arkansas. Those effects will be overwhelming. But really what we are seeing with PM and ozone is really step one, with the conference in December possibly leading us to step two, which will be equally devastating.

So I appreciate the hearing today. I look forward to the testimony.

Mr. Chairman, there's been much said about children, and I think about the tremendous costs of these new standards, and if we would take just some of those resources and put that into children's health care, put that into asthma research. The evidence seems clear to me that changing the ozone standards is not going to—the big question is, how many lives does that save? How much impact does that have on asthma? If we really care about children, the enormous costs associated with these new standards, we could take that, put that in children's health care, and do far more to benefit the children of this country.

But I look forward to the testimony and I thank you for calling the hearing.

Senator INHOFE. Thank you, Senator Hutchinson.

We have plenty of time for the remainder of the opening statements.

Senator Allard.

OPENING STATEMENT OF HON. WAYNE ALLARD, U.S. SENATOR FROM THE STATE OF COLORADO

Senator ALLARD. Thank you, Mr. Chairman. Again I'd like to thank you. I think you are doing a great job of pursuing this particular issue. We do need to have a number of hearings in order to get a thorough understanding of what these regulations do and don't do, and understand the science that's behind them.

I come from a State that's rather unique. It's one of the fastest growing areas in the whole country. Because of our high altitude we have some particular problems related to the high altitude is-

sues, and I think that's an issue that we have to deal with in our States that other States probably don't have to deal with, and obviously what science we do in relation to that, I'd be very interested in. I have a newspaper clipping here in front of me that talks about how these rules and regulations in effect are going to increase the particulate matter in Denver, and it's an article in the—and if you have time to address that, I may not be here to ask that question because I do have a bill up in another committee. If I get back I'll probably bring that question back for you to answer. But even if you don't get a chance to answer it here in the committee, I'll try and submit a question to you. You can come back to us in writing.

Also, Carol Browner had made a number of comments in front of the Ag Committee here on the Senate side, and I have some questions in regard to that.

I'm not sure the rules and regulations allow, on the Clean Air provision, any agency to set out a certain group to be treated differently from anybody else, and when you keep that in mind, she says it's not going to have any impact on agriculture. I have a hard time understanding how it's not going to have an impact without a provision in there that would allow her to set out a certain group as exempt from provisions. I just don't think those are there, but maybe I need some education in that regard.

So I think the bottom line is that these new rules and regulations that are being proposed are going to affect everybody in this country. I think people have to understand fully how it's going to affect them, how much it's going to cost, and best we can to educate the science behind it, and for that reason I commend the Chairman and commend those that are going to testify today for your input on this most important issue.

Thank you very much.

Senator INHOFE. Thank you, Mr. Allard. Senator Allard—I would also observe agriculture isn't the only area that she said would be exempt. The Conference of Mayors is going to be exempt and small business and others, so we'll need to find out how they are going to do that.

Senator Sessions.

OPENING STATEMENT OF HON. JEFF SESSIONS, U.S. SENATOR FROM THE STATE OF ALABAMA

Senator SESSIONS. Thank you, Mr. Chairman. I really do believe this is an important subject for our Nation to deal with, and it must be confronted honestly and directly. The air does appear to be getting cleaner in America, because we took some tough stands and we've made progress and we're continuing to make progress. But as we accelerate the demands to reach an even more naturally pure level of air, it adds costs to our Nation. It seems to me that costs can get so high that it does, in fact, make us noncompetitive in the world marketplace. There is a limit to which we can burden ourselves. It seems to me, Mr. Chairman, there's no difference between a tax and a regulation. There's no difference in telling the Tennessee Valley Authority that they've got to spend $2 billion, and that's what the Director testified here, that he thought these regulations would cost them on their clean air requirements, to spend $2 billion on improving the air, which they are passing on

to the ratepayers in that regard or imposing a tax of $2 billion, and so there the power industry serves America. It serves people. To burden them extraordinarily is a burden on the average rate payer. It's a tax on the rate payer, and we ought to ask ourselves if we're going to have the TVA rate payers pay $2 billion in extra regulative fees, or tax fees? Would it be better, as Senator Hutchinson says, to spend that money on asthma research, or emphysema research, or heart research, or AIDS research? This is an appropriation of the resources of our Nation. It just cannot be done without being oblivious to the impact it has on the Nation's wealth, and how it ought to be allocated for the overall good of America, and since we do have the reports of the CASAC committee, EPA's own committee, questioning the benefits from it, I just think that I don't want to be involved. I don't want to have to question these issues. I know you don't, Mr. Chairman. We do not want to be here. But we've got to be here because we're charged with setting public policy for America, and I hope that we can ask the questions honestly, and not be intimidated by political maneuverings, and try to do what's right for the country. That's what I want to do, and I am interested in proceeding, and thank you for your leadership.

Senator INHOFE. Thank you, Senator Sessions.

If it's all right Ms. Nichols, we'll recess for just a few minutes, go vote twice, and be right back.

[Recess.]

Senator INHOFE. We'll reconvene our meeting, and I would acknowledge that Mr. Jonathan Cannon, General Counsel for the EPA, has joined Ms. Nichols at the table, and we welcome you also, and while we normally have opening statements confined to 5 minutes, we won't confine you to 5 minutes, Ms. Nichols, because you are the only witness today. So we recognize you now for opening statements. I would observe that several others are up behind me and will be here shortly.

STATEMENT OF MARY D. NICHOLS, ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY; ACCOMPANIED BY JON CANNON, GENERAL COUNSEL

Ms. NICHOLS. Thank you, Mr. Chairman.

I do have a rather lengthy written statement which I know has been submitted for the record. I will try to keep my opening brief because you raised a number of important questions and I believe other members have questions as well.

I do appreciate your interest and your continuing oversight of our——

Senator INHOFE. You might move the microphone closer, if you would please.

Ms. NICHOLS. Yes.

The ozone and particulate matter standards, which were announced by the President last month and published last week, are the most significant step we've taken in a generation to protect the American people, and especially our children, from the hazards of air pollution. Together they will protect 125 million Americans, including 35 million children, from the adverse health effects of breathing polluted air. They will prevent approximately 15,000 pre-

mature deaths, about 350,000 cases of aggravated asthma, and nearly a million cases of significantly decreased lung functions in children.

Clearly the best available science shows that the previous standards were not adequately protecting Americans from the hazards of breathing polluted air. Revising these standards will bring enormous health benefits to the Nation. That is why we took action on clean air.

Mr. Chairman, you asked me to come before the committee today to discuss how EPA intends to implement these new air quality standards. In brief, we intend to work closely with the States to take advantage of the recent progress we've made in understanding the regional nature of air pollution, and the most cost-effective ways to reduce it, using the power of the marketplace. We also intend to assure that States making good progress toward attaining the current, or the old standards, will continue that progress, uninterrupted, with a minimum of additional burden.

Perhaps the most innovative aspect of this implementation strategy is that it allows the States to use a market trading system to address pollution on a regional scale. The heart of this system is a voluntary trading plan for emissions from utilities, one designed collectively by the 37 States that participated in the Ozone Transport Assessment Group, which we call OTAG, that will address violations far downwind and will provide the most cost-effective pollution reductions by achieving the bulk of reductions from major sources rather than small businesses or farmers.

Based on OTAG's recommendations, in September 1997, EPA will propose a rule requiring States in the OTAG region that are significantly contributing to nonattainment or interfering with maintenance of attainment in downwind States to submit State implementation plans to reduce their interstate pollution and describing the trading plan which the States can adopt if they so choose. Based on EPA's review of the latest modeling, a regional approach, coupled with the implementation of other already existing State and Federal Clean Air Act requirements, will allow the vast majority of areas which currently meet the 1-hour ozone standard to meet the 8-hour standard without additional local controls.

In addition to this regional approach, EPA will also encourage the States to design strategies for attaining the particulate and ozone standards that focus on getting low-cost reductions first. Such strategies will include the use of concepts such as a Clean Air Investment Fund, which would allow sources facing control costs higher than $10,000 per ton for any of these pollutants, some of which they may exceed by about a factor of four under any controls which are currently required. Anybody who had a cost of over $10,000 per ton would be allowed to pay a set annual amount/ton to fund cost-effective emissions reductions from nontraditional or smaller sources.

Compliance strategies like this will likely lower the cost of attaining the standards through more efficient allocation, minimizing the regulatory burden for small and large pollution sources, and serving to stimulate technology innovation as well.

To insure that the final details of the implementation strategy are practical, incorporate common sense, and provide for appro-

priate steps toward cleaning the air, input is needed from many stakeholders, including representatives of State and local governments, industry, environmental organizations, and Federal agencies. EPA will continue seeking advice from a range of stakeholders, and, after evaluating their input, will propose the necessary guidance to make these approaches work.

In particular, EPA plans to continue working with the Subcommittee on Implementation of Ozone, Particulate Matter, and Regional Haze Rules, which EPA established, to develop innovative, flexible, and cost-effective implementation strategies. EPA plans to issue all guidance and rules necessary for this implementation strategy by the end of 1998.

EPA will continue to work with the Small Business Administration because small businesses are particularly concerned about the potential impact resulting from future control measures to meet the revised PM and ozone standards. In partnership with the SBA, EPA will work with States to include in their SIPs flexible regulatory alternatives, which minimize the economic impact and paperwork burden on small businesses to the greatest degree possible, consistent with public health protection.

In summary, Mr. Chairman, EPA believes that the new ozone and particulate matter standards will provide important new health protection and will improve the lives of Americans in coming years. Our implementation strategy will insure that these new standards are implemented in a cost-effective and flexible manner. We hope to work closely with State and local governments, other Federal agencies, and other interested parties in order to accomplish this goal.

Mr. Chairman, that includes my prepared statement, and I look forward to answering your questions.

Senator INHOFE. Well, thank you, Ms. Nichols.

This is a very obvious question that I've wondered about, Ms. Nichols. Given the EPA implementation schedule of at least 6 years for ozone and, I think, 9 years for PM, and taking into account the new standards issued on—were issued on July 16, and ignoring existing programs, how many lives would be saved in the next 5 years?

Ms. NICHOLS. Mr. Chairman, you're asking about the impact of the new standards on top of the old standards?

Senator INHOFE. I'm talking about with those things that were not in the—not going to go on in the absence of the adoption of these standards. Just these standards, which we all agree are not going to go into effect for 6 or 9 years. How many lives in the next 5 years would be saved?

Ms. NICHOLS. I understand the question. Let me answer it this way, if I may. We have not estimated lives saved prior to the time when the standards are expected to be, at least, partially implemented in 2010. What we have said is that we want to layer the new standards on top of the existing standards because we recognize, based on the history of the Clean Air Act in the past, that from the time a standard is set until the time that the actual pollution reductions are being achieved, until you know, when industry has had time to design the technologies, when the regulations have come into effect, does take a period of years, in some cases a decade

or more, and so setting the standard just begins that process, and we acknowledge that the setting of the standard, in and of itself, does not cause the health benefits to be achieved.

Senator INHOFE. So it's safe to say that zero lives will be saved in the next 5 years?

Ms. NICHOLS. It would be safe to say that the lives that will be saved in the next 5 years are attributable primarily to today's standards, however it would be important, I think, to note that——

Senator INHOFE. The change in standards that would not be in effect for the period of time that we're talking about, 6 years or 9 years, they won't be in effect?

Ms. NICHOLS. Mr. Chairman, this is, I think, where we are having a semantic difference. The standards will be in effect, assuming that Congress doesn't overturn them, the issue is what will people be doing during that period of time, and what we believe people will be doing during that period of time is continuing work on the current, or the old standards, and also beginning the planning for that work that they will be doing on the new standards. So it's correct to say that there will not be new regulations in place, implementing those new standards, but there will be a lot of planning work, and in some cases, I think there will be industries that will choose when they're making decisions about which technologies to purchase or what investments to make, that will be looking toward the new standards. So we will see some actual impact of the standards in terms of——

Senator INHOFE. Will there be one life saved in the next 5 years?

Ms. NICHOLS. The lives that will be saved in the next 5 years, and I don't have a number for those although we could get that for you, will be lives that are attributable to today's standards, I believe, primarily. Although again——

Senator INHOFE. That's today's standards. I'm talking about with the new standards will there be a life saved in the next 5 years?

Ms. NICHOLS. I think it's difficult to quantify whether there would be, based on the choices that people will make in looking toward the new standards, but I think there is a down payment on those new standards that will have an impact, and we'll just have to try to get back to you to see if we can add some additional quantification to that.

Senator INHOFE. Well, let's assume then that there won't be any new—any lives saved in the next 5 years. I mean, I still—I haven't heard anything that you've said that would imply to me or that would persuade me to the notion that any lives are going to be saved in the next 5 years.

Ms. NICHOLS. Let me say it this way, and I——

Senator INHOFE. And then I would have to say, what will we do about what CASAC, and the scientific community would suggest postponing these until such time as science determines whether or not they're—since we're not going to be changing—making the changes anyway?

Ms. NICHOLS. Mr. Chairman, I don't believe that CASAC told us to defer making a decision on the standards. I believe CASAC asked us, by a vote of 19–2, to set a standard for fine particles. There was some dispute, which you have gone into in previous hearings, as to whether the 24-hour or the annual standard should

be controlling, what the precise level should be, but there was not a question about whether to set a standard, and the reason for that is that CASAC recognized that the planning work that needs to be done by States and by industries in order to achieve a standard, takes many years to accomplish, and so the setting of the standard only begins that process.

You are correct to point out that it won't all be completed within that 5-year period.

Senator INHOFE. You can set, but not implement, and you are saying by setting and not implementing there are—there are going to be—there could be some lives saved because this somehow changes behavioral patterns?

Ms. NICHOLS. No, Mr. Chairman. What I am saying is that implementation includes a great deal of planning work, and in the course of doing that planning there will be actual decisions made, actions taken, that will have an effect, but we haven't tried to quantify that.

Senator INHOFE. Were you at the Ag hearing on Tuesday?

Ms. NICHOLS. Yes, I was.

Senator INHOFE. Carol Browner said, and this is a quote, "We will have the next 5-year review before anyone reduces pollution." Now what parts of this would you implement that would save lives now? I guess that's what I am asking.

Ms. NICHOLS. Mr. Chairman, as the Administrator said, and I agree with this, there are not regulations that will be in effect requiring people to reduce more pollution than is required to be reduced for the old standards prior to the next 5-year review. But because the standards are in effect, there will be people taking actions, and I do believe that some of those actions will, in fact, be beneficial toward attainment of the new, as well as the old, standards.

Senator INHOFE. But that Ag hearing on Tuesday, Administrator Browner cited the OTAG program as a way for Eastern States to meet the new ozone standards painlessly. In response to Senator Landrieu's question she identified Louisiana as an example, saying they currently have four parishes in nonattainment and three more new parishes expected. She said that OTAG would provide cleaner air in all seven parishes without requiring new controls in these seven parishes. Does that accurately—do you recall her making that statement?

Ms. NICHOLS. In general that's consistent with what I heard, sir.

Senator INHOFE. Well, how will these parishes get cleaner air if they don't have—without any new controls?

Ms. NICHOLS. Ah, the——

Senator INHOFE. Where would the controls be placed to result in cleaner air in Louisiana?

Ms. NICHOLS. The key here is the controls on large generators of electric power and other very large generators who——

Senator INHOFE. Where?

Ms. NICHOLS [continuing]. Who will be located throughout the OTAG region. I'm not aware, sir, of whether there are any power plants located in the parishes that you identified. So I can't respond to that particular part of your question. In general, the power plants are located around the country. In many States they

are frequently located in areas or counties that are actually designated as attainment areas today, because the immediate area around that facility may be meeting the standards, but that plant is contributing, because of the problem of long-range transport of pollution, that plant is causing or contributing to a problem——

SENATOR INHOFE. Where is that plant located that you are referring to?

Ms. NICHOLS. There are many of them. I was saying a plant——

Senator INHOFE. Would you say to the west of Louisiana?

Ms. NICHOLS. There are plants probably within Louisiana that are subject to this type of a control program.

Senator INHOFE. I was quoting the Administrator when she said that OTAG would provide cleaner air in all seven parishes without requiring any new controls in those seven parishes. Would you conclude that there are no—none of these plants as you'd describe them in those seven parishes?

Ms. NICHOLS. I would have to go back and consult a map of the OTAG region and where the power plants are. What the Administrator was referring to in her testimony is the modeling work that was done by OTAG, in which the States that participated in OTAG did various modeling runs looking at control strategies, and the conclusion was that with a cap on the utility emissions of nitrogen oxides in that region, that includes Louisiana, that every county or parish which would not meet, based on today's data, the new ozone standard would come into attainment. So its based on that modeling work.

Senator INHOFE. But she said no new controls would take place in any of the seven parishes.

Ms. NICHOLS. As I said, sir——

Senator INHOFE. There has to be—if this is somehow going to end up in favorably affecting our environment, somewhere there have to be controls, and I think in the opening statements that were heard on this side of the aisle—one of the things that is a little frustrating is that each group that appears—they say, "Oh, no, don't worry about it. You're not going to be affected. This is just going to be the other people," or whatever is stated is, "Well, you're not going to be affected. It's someone to the west of you." But sooner or later someone is going to have to be affected, and new controls are going to have to go in, and my question to you is you know you can't build support for a program that has no basis in science by continuing to say that no one's going to be affected. It's going to be the guy—somebody else.

Somewhere in this case, somewhere there's going to have to be controls to bring the results that it—were described in the seven parishes in Louisiana.

Ms. NICHOLS. Yes, Mr. Chairman, what we are referring to by the OTAG strategy is a system of controls on power plants around the 37 State region, which was modeled as part of the OTAG work. I can't at this moment tell you precisely which power plants in Louisiana, whether they are in those seven parishes or not, are the ones that would need to be participating in a control program. Clearly someone——

Senator INHOFE. But, wait a minute, wait a minute. None of them are in there. None of them would be there in the seven parishes, because that's what the Administrator said.

Ms. NICHOLS. As I said, I would have to check the location of where the power plants are. I think what the Administrator was referring to was the issue of whether there would be a need for additional controls on local businesses above and beyond the OTAG control program. We've assumed the OTAG control program going into effect. We're not denying, in fact we're encouraging people to understand what the implications——

Senator INHOFE. But that's not what she said. She said that the—she said the OTAG would provide cleaner air in all seven parishes without requiring new controls in these seven parishes. That doesn't mean new controls on some businesses or some industries or some farms or——

Ms. NICHOLS. Yes.

Senator INHOFE. So you're saying there would be no controls in these—you're going to have cleaner air without any new controls in the seven parishes. You agree with the Administrator?

Ms. NICHOLS. I agree that beyond OTAG there would not be a need for further, any further, local controls in those seven parishes for the new ozone standard. We're just talking ozone.

Senator INHOFE. So OTAG then, that's regional so somebody else is going to have to have new standards so that they'll be able to clean up their air in Louisiana, but it won't be in Louisiana. So where's it going to be?

Ms. NICHOLS. It may be elsewhere in Louisiana. That's why I mentioned the fact that I'm not certain where the power plants that were modeled are located, sir.

Senator INHOFE. Senator Hutchinson.

Senator HUTCHINSON. Thank you, Mr. Chairman, and I certainly—I agree with your comments that it seems to be that EPA is giving assurances to all these various sectors that, "Don't worry. It's not going to be that bad, and that you're not going to be negatively impacted," and—would you just kind of reiterate for me, as a Senator from an agricultural State, what those reassurances are? I mean, what do I tell the farmers in the delta?

Ms. NICHOLS. Well, Senator Hutchinson, if I could just step back a second. I think the point we're trying to get across with this implementation strategy is that we want these new health standards to come into effect in a way that's orderly, that doesn't disrupt the work that many communities are already doing, that many industries are already doing, and that provides an ample amount of time, in the case of the fine particles standard, to develop the most cost-effective possible control strategies.

With respect to the particulate standard, we are taking advantage of the provisions of the Clean Air Act that allow for a period of time during which areas are designated as unclassifiable, and in which further monitoring can be done, as well as an additional review of the research in order to develop the most cost-effective possible control strategies.

With respect to the conversations with agriculture, during the inter-agency review process that we engaged in within the Administration, as well as in response to the public process, the public

comments and so forth, we heard a lot about the concerns of agriculture. I, myself, serve as a member of an Air Quality Advisory Committee that the Department of Agriculture has set up under the Farm bill that was passed in the last Congress, and we worked with the Department of Agriculture on a memorandum of agreement—the memorandum itself is in process, but it's reflected in a letter that Carol Browner sent to Secretary Glickman on a couple of specific issues.

Because we wanted to make sure that States were focusing on the most cost-effective methods first in order to start thinking about the new fine particle standard. We believe, based on the work that's been done to date, that agricultural practices in general shouldn't be the focus of people's activities when they are thinking about how to meet a new fine particle standard, and that's not based on just a policy choice that we've made. It's based on our science review on the information that we have available about where the particles are coming from, and so we have sought to have conversations both with the department and with groups that represent the agricultural interest in order to explain to them why this is so and why we would like to work with them and others to make sure they are not the focus of attention when it comes to planning for attainment.

Senator HUTCHINSON. OK, that was a lengthy answer. If I could distill that. What I got was that you're having conversations with the Department of Agriculture, that you're working on a memorandum, and that you don't want agriculture to be the focus.

Ms. NICHOLS. It's not just that we don't want them to be the focus, it's that based on the information that we know about fine particles today, we don't believe that they will be the focus because their particular particles are not what we're worried about.

Senator HUTCHINSON. So you don't believe it's going to be the focus. Now what if a State, when they come up with their implementation plan to cite, they're going to make it the focus, and they're going to—really going to come in with some very strong regulations regarding all the things, all the concerns that have been expressed by the farming community.

Is there any—when you talk about your conversations with the Department of Agriculture, is there any assurances that the States won't do that?

Ms. NICHOLS. I think there are several kinds of assurances. First of all, there's the time period. No State is going to be submitting a plan for attainment of the new fine particles standard until 2005–2008. During that period of time we will be working with the States in developing both guidance and regulations for the States, to tell the States what they should put into their State implementation plans. One——

Senator HUTCHINSON. Will you tell them what to put in?

Ms. NICHOLS. We tell the States a number of specific things about what needs to be in an implementation plan. One of the things that we do tell States is what types of monitoring information we're going to require, what types of assurances they need to submit to show that the $PM_{2.5}$ standard is going to be achieved. The reason why we don't think that States would be pursuing $PM_{2.5}$ strategies, such as the kinds of things you may be alluding

to that farmers would fear, is that those practices are not going to be able to—they won't show that those things are actually going to achieve the $PM_{2.5}$ standard because they are not aimed at $PM_{2.5}$.

Senator HUTCHINSON. Well, first of all let me just say that I think farmers—that the impact upon agriculture goes far beyond whether or not they're going to be able to go out a plow up their fields, and whether that's going to—that increase—if you go after power plants, you increase energy costs, that dramatically impacts the farming community.

But, it was interesting to me, she talked about these implementation plans that you actually dictate to the States, at least some of what they have to put in based upon your own decision as to whether or not it will put them in attainment. And it—my understanding of what the EPA's argument is on why they are not subject to, and required to abide by, the Small Business Regulatory Fairness Act, it is because you're not actually implementing the standards, the States are, and yet you have just told me that when the State plans, you're going to come in and specifically, in some areas, dictate. So that seemed to me that that undercuts your entire legal argument that you're not subject to the Small Business Regulatory Fairness Act.

Senator INHOFE. Senator Hutchinson, I might observe that even though he was not on the schedule to be here, we do have Jonathan Cannon, who is the General Counsel. We're glad he is here, and he might want to respond to that.

Ms. NICHOLS. Well, could I just—before I turn to Mr. Cannon for legal advice—just respond to the point that Senator Hutchinson was making about how we work with the States on developing implementation plans, because that is a matter of practice, and if I may say, having run a State environmental agency before I came to this job, it is a dynamic process. But the way it works is EPA sets an air quality standard. That's the goal. The State has to come up with a program to achieve it. EPA has to approve those plans. Our basis for approving or disapproving those plans is whether they demonstrate that a State is able to attain the standard. That's our only role. The State has a choice about which measures it puts into the plan, but we would look at those measures to see whether the measures were going to be getting $PM_{2.5}$——

Senator HUTCHINSON. Well, Ms. Nichols, I was only taking what you said in your original answer, and that was that you tell the States in certain areas what they've got to put in the plan and that, to me, seems to totally undermine your argument that this is a State decision, and therefore, you are not subject to the Small Business Regulatory——

Ms. NICHOLS. If I may just finish. There are some elements of what goes into a plan that are mandatory, for example air quality data. We mandate to the State they have to give us the air quality data. If they don't give us the air quality data, their SIP isn't approved. That is a mandatory element of a SIP. However, the choice of the control strategies, if they add up to the amount of reductions that are needed to meet the standards, is the State's. That's all I was trying to——

Senator HUTCHINSON. What I'm trying to say is that I don't think you can have it both ways, and I guess the courts will ultimately

decide that, and I know Mr. Cannon will respond to that, but I think what you have just told me in your answer really undercuts your argument, and the assurances you are giving the agricultural sector flies in the face of your legal arguments that you're not subject to the Small Business——

Ms. NICHOLS. Mr. Hutchinson, the controls that we're talking about, the reason why I'm focusing on agriculture here, I'll just try put it in a different way. The emissions that agriculture, itself, is causing whether it's their tilling practices, or dust blowing from fields, applications of fertilizers, etc. As we have looked at those emissions, in most instances it's not $PM_{2.5}$ that they are emitting. Addressing those practices is not going to be approvable because it isn't going to be solving the problem. That's the only reason I'm suggesting that we have some degree of assurance that those measures won't be in the plan. It's not because we're going to be dictating to the States that they shouldn't use them.

Senator HUTCHINSON. But you did say that there are areas that you do dictate. That there are mandates on the States on what they have to have in the implementation plans, and that if they don't have them you come in and tell them you must have that by law.

Ms. NICHOLS. But those are the procedural, or basic framework, elements of the plan. They are not the choices of the control measures, except to the extent that the Clean Air Act may specifically dictate some measures be included.

Mr. CANNON. I'd like——

Senator INHOFE. Would you pull the microphone a little closer so that we could hear you, Mr. Cannon?

Mr. CANNON. I think Ms. Nichols has summarized the law accurately. There are within the requirements of the statute applicable to State implementation plans, specific requirements as to the form of those plans and some of the particular requirements. But generally the States have at their discretion to determine the means and measures by which they are to achieve attainment of the standard, and EPA is required to approve the plan once submitted. If the State's plan demonstrates it's going to——

Senator HUTCHINSON. I wonder if you——

Mr. CANNON. I think Ms. Nichols' point is for agricultural enterprises, to the extent that they are not the source of the problem——

Senator HUTCHINSON. But what if a State decided they were to write a plan and they came in with some very stringent requirements and regulations on agricultural sector tilling and whatever else, but they had enough other measures that would bring the State into attainment? They weren't solely dependent upon the agricultural changes? In that case they would be in compliance with your requirements, correct? I mean you couldn't say, "Take that out because it's unnecessary, because that's a focus that's not really essential"?

Ms. NICHOLS. Actually, Senator, in my past experience, this isn't an issue that we faced in the particular way you're describing. But there are many States that have measures on the books which are over and above what's called for by the Clean Air Act, over and above what's mandatory, and EPA does not make those measures

federally enforceable. So, in other words, there may be on the books some State regulations that are part of the State program that they choose to do for whatever reasons, but we do not include those——

Senator HUTCHINSON. So the reassurances to the farming sector are really dependent upon the goodwill and good faith of the States, and the implementation plans that they might design.

Ms. NICHOLS. I think that the reassurance to the States are that EPA is not No. 1 either advising or encouraging States to do things that would not be effective with respect to looking at agriculture and second, that we will give guidance to the States as to what they should be looking at based on our technical knowledge in this area, and that, again, that's not agriculture.

Senator HUTCHINSON. So you—I take it you do that now, that you give guidance to the States and yet we find many States that have standards that exceed the standards of EPA. Some——

Ms. NICHOLS. Under the framework of the act, any State is always free to set more stringent air standards, and there are a number of States in this country that have air quality standards that are stricter than EPA's standards. What we do try to do is set a floor, the basic level that we believe is what the act told us to do for a national air quality standard.

Senator HUTCHINSON. Well, I know I have taken a long time. It seems to me though, that it's a very tenuous legal position to say we're not subject to SBREA, but—because we're leaving that to the States, and then to say we give them guidance. We tell them the data they've got to have. We give the floor. That's, I think, a very tenuous position.

Administrator Browner in her comments last Thursday to the Center for National Policy stated that reducing utility emissions was, in her words, the first small step in addressing the Nation's air quality problems. What percentage of the emissions are you attempting to regulate with these new standards, or what percentage of the emissions will come from power plants, and what other steps does your agency intend to take after reducing utility emissions if those reductions do not achieve the first—the desired results? If she's saying this is the first step, what do you see is going to come from that first step and after the first step, what else has to be done?

Ms. NICHOLS. The reductions in utility emissions of Nitrogen Oxides that we refer to as the OTAG program, or the Cap and Trade program, will reduce the percentage of emissions by different amounts in different States. But overall, it will reduce the contributions that any States are making to the interference with attaining or maintaining the standards in their downwind States. To a sufficient degree that the new areas that won't achieve the ozone standard will be brought into attainment, old areas that have not yet achieved the standard we believe are capable of reaching attainment with what they're already doing to achieve the 1-hour standard that's on the books, plus what they'll get from OTAG, from the utilities strategies, except for a couple of major urban areas which will continue to have serious attainment problems.

Based on the modeling that we've done to date, New York, Chicago, Atlanta, Houston, and Los Angeles are the areas that don't

come into attainment just as a result of the controls that are already on the books or in the process of being implemented, including all of the national measures that EPA is responsible for, such as cleaner engines for trucks, locomotives, buses, etc.

Senator HUTCHINSON. So what do they do?

Ms. NICHOLS. Those areas will need additional local controls, and at this point the kinds of controls that they would be looking at would be controls on emissions of volatile organic compounds and some additional reductions on Nitrogen Oxides emissions. There are a number of technologies——

Senator HUTCHINSON. Can you put that in practical terms as to what they might have to do?

Ms. NICHOLS. Sure. We have listed a number of technologies that are coming into play over the next few years. We have not specifically put out emissions estimates for these technologies because we are talking about a period after the year, 2010, and frankly, at this point, we have technologies which have been invented, which have been demonstrated, but which have not been put into production at a level where we can quantify the exact reductions.

Senator HUTCHINSON. The year, 2010, sounds very reassuring, but my understanding is that the modeling that was conducted during the OTAG process showed that even with 85 percent reductions in utility emissions in the Eastern United States there would be numerous areas still that could not achieve attainment under the old ozone standards. So it seems that the 2010 date is not very reassuring when they can't even comply with the existing—with the ozone standards—the old ozone standards.

Thank you, Mr. Chairman.

Senator INHOFE. Thank you, Senator Hutchinson.

Senator Sessions, let me just bring you up to date with a couple of things that we've been covering. I—I was trying to establish from Ms. Nichols, yet admittedly they're not going to be implemented until, in the case of ozone, 6 years; in the case of particulate matter, 9 years; how she can say that it will save lives by doing it today, even though it won't be implemented—and I—she has answered me, but I didn't understand her answer.

The other area that we pursued was a statement that was made to Senator Landrieu in the Ag Committee meeting, I think that's where it was, where they said there are seven parishes that would be out of attainment, but that they would be able to come back into attainment without any—requiring new controls, and this gets into the OTAG thing where you can always plainly say well, we are going to control someone to the west of you or something like this.

Then, of course, Senator Hutchinson pursued the issue, since he is from an ag State as you and I are, how ag can be for all practical purposes exempt, and so that's where we are right now.

Senator Hutchinson.

Senator SESSIONS. Sessions.

Senator INHOFE. Sessions, yes.

Senator SESSIONS. Mr. Chairman, it is a—and I am very sorry I was not promptly able to return.

It does appear, would you not agree, Ms. Nichols, that there is a focus on the electric power generating industry. They are going to take some additional pressures in this regard?

Ms. NICHOLS. Yes, Senator. We've identified this particular sector as the result of the work we did with the States on OTAG as the one which has the most available reductions in the sense that, in may instances, they have done less to control their emissions than many other sectors, and where there are cost-effective reductions that could be put in place that would make a big difference in achieving the—both the old standards and the new standards.

Senator SESSIONS. But I think there's some concern that they're targeting that industry. It has the ability to pass on its increased costs directly almost to its customers. They're for the most part, until we achieve deregulation, they are State controlled monopolies. As Attorney General, we had a minor role to play with the Public Service Commission in reviewing the rate proposals of the power companies. I've just received word, I think the last week that, or earlier this week, that TVA plans to increase its rates 5 percent, the first increase in 10 years. According to numbers we have from them, they spent, let's see, they'll be spending now $4 billion on, really I guess the acid rain controls and other previous controls, and they're estimating, contrary to what I said earlier, $2 billion or another $3 billion to meet these standards if they go into effect. Have you—and of course those will be paid by rural utilities—Tennessee Valley Authority members in Tennessee and Alabama, Mississippi, Georgia, wherever. Are you sure you're not asking too much of the utility industry, because it will be passed straight to the customers?

Ms. NICHOLS. Senator, you've raised a very good issue about what's going on with the utility industry, and, of course, it does differ State by State. Many States are proceeding with restructuring of their utilities even before there's a Federal mandate to do so. But, in any event, as the industry does restructure and as competition becomes more prevalent in the industry, there's a great opportunity to both reduce the cost of electricity to the consumers and also to deal with the pollution problems that this industry does create at the same time. Clearly there is a cost, as I indicated earlier. The reason why we are in favor of a cap and trade system, which would be implemented across State lines and throughout the region, is that we believe that you can achieve the greatest possible reductions at the lowest cost if you follow the model that was used in the acid rain program, because while any individual utility may face higher costs if they have to install equipment, such as a scrubber, when the entire group of companies in a region is participating in a cap and trade system, then it's possible for the higher cost utility to purchase excess emissions allowances from another utility and, in effect, reap the savings for their customers, and when you are dealing with a regional pollutant, such as nitrogen oxides, we believe that this is a very appropriate way to go about reducing the pollution rather than making any one source responsible for just what's in their area.

Senator SESSIONS. Well, I've got to say that I really can't agree with that in the sense that competition may drive down costs, which we would hope it would, and that would benefit everybody, but if we're going to not benefit from that because of pollution controls that are more severe than necessary, then we have taken money and allocated resources of this Nation in areas that are not

a benefit. According to TVA, the proposed standards could lead to increased energy costs in the TVA region of 11 percent, resulting in 40–50,000 fewer jobs, is what I have in a report from them. Have you—does that cause you any concern?

Ms. NICHOLS. I'm always concerned about cost numbers and job figures of that sort, Senator. TVA did actively participate, along with many other utilities, in the OTAG process, and, as you know, the Department of Energy, which has some authority over the TVA, also was very active in the inter-Agency review process on the standards and on the implementation strategy. They have endorsed this cap and trade program while recognizing that there's a need to fine tune both the allotments and the methodology as we move forward with the program. So, it may be that there may be some differences in terms of the amounts that different States would have to contribute based on their location and their impact on other States. But in terms of the general principle that there is a need to cap and to allow for cross-border trading, I believe that there is general support of that as a method.

The issue that you raise, of course, is, it needed to clear up the air, and I think that on that front we have pretty good evidence, based on a ranking of other types of control measures, that the utility NO_X emissions are at this point the single largest factor in terms of creating the cross-border ozone transport problems.

Senator SESSIONS. Well, the concern is that to me—I'll just tell you what my concern is. I think that's a way that hides the cost. If you said that people had to change their automobiles directly, and they're no longer going to have diesel engines, they're no longer—this innate—they feel that. But if you take—whack the utilities and they pass it along in increased rates, nobody really knows what's happened, and I know I may be talking about a subject people don't want to talk about anymore, but there are two nuclear reactors in the TVA system sitting idle today, one of them 80 percent complete, that would have polluted—provided no air pollution, and EPA regulations or the international energy—nuclear energy regulations have really stopped that, and that's been a real burden on the whole power industry in the Tennessee valley. So, I wanted to raise that point.

Did you discuss the fact that in the implementation standards that you've issued, or made public, are the vast majority of areas that do not currently meet the new ozone standards will be able to do so without any addition new pollution controls and measures? Is that the position—that's your position on that?

Ms. NICHOLS. Yes, Senator Inhofe, I think——

Senator SESSIONS. You discussed that, you think, thoroughly?

Ms. NICHOLS. Well, I'll be happy to go further if you——

Senator SESSIONS. I don't want to——

Senator INHOFE. Further, maybe he'll——

Senator SESSIONS. I'd just like to know how you can reduce them without any burden on anyone.

Ms. NICHOLS. Well, Senator, I think maybe there is a missing word of "local" in that sentence, and, if so, we should clarify the point. I think the point there is that with the OTAG controls, with the utility cap and trade system in place, we believe there is not a reason or a necessity for additional local control measure in the

areas that meet today's ozone standard, but will not meet the 8-hour new standard. In other words, those areas which today are essentially marginal, they are close to the old standards, they don't quite make the new standards. Because of the regional benefits of the capping of the utility emissions, those areas will be able to come into attainment with that plus the additional cleaner cars, cleaner fuels, and other measures that are already being provided by the Federal Government, in effect, that are already part of today's Clean Air Act. So the point is that there would not be a need for local controls on businesses in those areas.

Senator SESSIONS. So then you are going to take it out of the utility industry?

Ms. NICHOLS. Sir, I hate to sound like a defender of the auto industry, and they probably wouldn't want me to do it. But I would say that if you look at the amount that they have controlled and the amount that has been already passed on to consumers, in order to clean up those tailpipe emissions, we are talking, in the case of cars, about reductions of 90 percent twice over, and at cost levels that well exceed the $1500 per ton that we believe is what it's going to cost for these NO_X controls. Admittedly, the consumer is the one who ultimately sees these costs. There's no question about that. But we believe that those costs are quite modest in comparison with the costs that have already been borne by other industries.

Senator SESSIONS. What about the particulate matter, the PM count, how much are you expecting out of utilities on that, and can—will they be able to meet the burden in utilities alone?

Ms. NICHOLS. Clearly at this point, Senator, we are not in a position to spell out the entire control program for $PM_{2.5}$. We do know that the acid rain program that is in effect today for controlling sulfur emissions from utilities will achieve about 40 percent of the reductions that we think are needed for $PM_{2.5}$. So, in other words, this industry has already made, or is in the process of making a very significant down payment on controls of $PM_{2.5}$. The NO_X reductions that we are hoping to get from the OTAG program will also help with $PM_{2.5}$. One of the benefits of doing both the ozone and the PM standards at the same time is that we can, in effect, take credit for measures that really will work for both, because the Nitrogen Oxide emissions, in addition to forming ozone, also are causing formation of nitrates which are one of the large ingredients of the fine particle problem. So, I think at this point it is fair to say that these controls we are looking at under OTAG will get us to where we need to go, at least for the next decade or so. After that I can't say.

Senator SESSIONS. You are not prepared to say what other industries that you'd be—that would be expected to bear burdens to get the PM standards in attainment?

Ms. NICHOLS. Well, sir, I think in general what we know about $PM_{2.5}$ today is that it's primarily a product of combustion of fuels. So it's undoubtedly looking at all sorts of combustion sources and looking at the quality of the fuels. But we really do want to do further research before we pinpoint which specific types of control measures would be the most beneficial.

Senator SESSIONS. Let me ask you this, Ms. Nichols, let's say that we're not supposed to worry about this because it's going to be 6 years before it takes effect. Why don't we wait about 3 years, and do a lot of research in the interim, and maybe we could identify particular types of emissions that are more particularly health adverse, and utilize those resources. Again we are spending American citizens resources in the most effective way. Would you respond to that thought?

Ms. NICHOLS. Senator, I think, maybe I would just go back to the structure of the Clean Air Act, which is unique among Federal environmental statues, at least to my knowledge, in that it sets ambitious goals, clearly says set the goal without regard to the cost, just based upon your public health information, the best science that you have, and then take your time and work out the attainment strategies. Over time, we think this approach has worked in the sense that we've seen time and time again that when you set a goal, even if it's an ambitious goal and at the time industry didn't know how they would attain, if you give them the time and the flexibility to get there, that they will come up with innovative controls. We think the market-based approach that Congress wrote into the 1990 amendments and urged us to use is a further way to make it clear that we shouldn't just be using prescriptive regulations to get there.

But ultimately, without a goal, people don't know where they are trying to head, and they don't make the kind of investments in research that are really necessary. I'm not just talking about health research or monitoring research. I'm really talking about the kinds of things that can only be done by the private sector when they look at what kinds of technologies and processes they can come up with. So having the standard out there, as we have done, gives them that target. We hear from industry frequently if we give them the time to do it, that they can meet standards. What they don't want is to be told precisely how to do it.

Senator SESSIONS. Well, I agree that the American and much of the world's business community is incredibly efficient and if they have to do something, they will. But we need to be sure as public policy that what we ask them to do is the best thing for them to do. If it's going to cost $30 billion to meet an ozone standard that maybe is not necessary to meet, we could—if TVA had $3 billion, goodness knows what we could do for the Tennessee River. We could buy huge tracts of land, preserve it for species and environmental concerns that could be there for the rest of our lives.

So I think we've got to think in terms of that. I just don't believe that the science is so clear that you can reach that level that the act triggers in that you've got to act today. I don't believe that you have to act today under the act. One more question and I'll finish. What is the EPA's latest evaluation of the cost of meeting both the PM and ozone standards?

Ms. NICHOLS. I just want to turn to the summary of the RIA here. For the particulate matter and ozone standards combined——

Senator SESSIONS. If you could break them up that would be helpful?

Ms. NICHOLS. I'll do both for you. For the combined standards, the partial attainment costs are $9.7 billion, and of that the particulate matter cost is $8.6 billion and the ozone cost is $1.1 billion.

Senator SESSIONS. Is that annually?

Ms. NICHOLS. These are—yes, these are annual numbers.

Senator SESSIONS. Well, I think there'll be much disagreement about that. Are you aware of the Scientific American article of January or December, earlier this year in which it discussed the fact that decline in particulate matter contributes to acid rain?

Ms. NICHOLS. No, sir, I'm not.

Senator SESSIONS. A lot of the particulate matter are base that neutralize acid, and really it was a very interesting article. So I just point that out to say that if we knew more about what type of items were causing the environmental damage, the—we could expend our resources better.

Mr. Chairman, I congratulate you on the work that you've done. The Alabama Department of Environmental Management has testified at your hearing in Oklahoma that our State would go from two counties, I think, out of attainment to at least 20, and perhaps 67. This would be a major detriment to the economic growth of Alabama. There've been a lot of studies done that state that poverty is an adverse health factor—perhaps one of the clearest—poorer people are less healthy. If increased attainment targets keep us from being competitive in the world market, a plant may not be built in Alabama. It may be built in Mexico or Brazil.

The County Commissioners in Jefferson and Shelby Counties are working to improve the air and they're making progress. They're going to be awfully depressed if they are faced with new standards that they cannot possibly meet. They are making progress at great effort, and they expressed their concerns to me. There's a county just outside of Birmingham—a rural county that oddly has one of the testing machines—it appears it will be out of attainment if you increase the standard, and it has almost no industry. So we don't want to hurt the working Alabamians and the working Americans.

I think we've don't want to have a fuss over this issue. I certainly don't. But I think we're going to have one because I'm not going to participate in a procedure that has marginal, if any, health benefits, but significantly adverse economic benefits the people of my State.

Ms. NICHOLS. Mr. Sessions.

Senator SESSIONS. Yes.

Ms. NICHOLS. If I could just comment on one point that you made. First of all, I agree with you. You think you need to be satisfied that we've carried out our responsibilities properly and we do welcome your oversight.

I did want to say something about the counties that you mentioned though, because I think that there's quite a bit of misapprehension or misinformation. Perhaps it was based on some of the ranges that were in the proposal which came out last November. We do have data and we have to be cautionary because it is current data. It doesn't reflect new monitoring that will be done. But the information that I have indicates that there are four counties in Alabama that don't meet today's .08 8-hour standard with the fourth maximum concentration. That would be Clay, Jefferson,

Madison, and Shelby counties based on what we know today. That there are two, and this is only based on, again, current data, not with all the new monitoring in place, that would be Etowa and Mobile, that wouldn't meet the $PM_{2.5}$. Now obviously we have more work to do, and we realize that we've got to come up with measures that people will feel can be met. But we do want to assure you of our desire to work with you on that and to work with your State to come up with a program that will succeed.

Senator SESSIONS. Well, the problem is that we don't have the monitors. There is a monitor, I think, in Clay County, which is a rural county, and it's put it out of attainment. The other counties don't have monitors, and we upped the standards and put out more monitors. Someone has been there for 30 years, a champion of clean air for the State and Nation, and he says this is going to be impossible to meet. He predicts that over 20 counties will be out of attainment. So I don't know where it would actually come out.

Ms. NICHOLS. Well, we need to put the monitors out there. Our plan for the monitoring is that we will be putting out about 1500 across the entire country for the basic Federal monitoring network. We've sought the funding for the Federal Government to pay so we don't put that burden on the States, and our belief is that with 1500 monitors we'll be concentrating on the major populations centers. From the point of view of cost-effectiveness, of controls, and of actually meeting the health goals, it doesn't make sense to be sticking the monitors in the middle of rural areas, at least to begin with. We need to be trying to measure what the impacts are on the population centers first.

Senator SESSIONS. Well, that's an odd approach, I mean, it seems the rules should be kept even wider. So those are my concerns, Mr. Chairman. I do recall in this room some weeks ago we had the physician from Pennsylvania, emergency room physician, and he was most articulate, and he documented how a few million dollars, this kind of money that we are expending on this, how many lives it would actually save in the emergency rooms, such as proposals to get people there quicker and better equipment all over American rural and small towns. He said you could actually save tremendous numbers of lives. He was very passionate about that, and he thought that it was unwise for us to deal with a situation that was very ephemeral and uncertain, and ignore an area that was certain. So I think that's where we are coming from.

Ms. NICHOLS. No, I hear you. I mean, I think it's a very valid point. I guess the only thing that I would say in response, and I realize this is sort of back to the Clean Air Act again, but I think the concept behind the law is that this is something, that is the air, that every single American experiences. The costs may be more focused, but the effects are felt by everybody to some degree or another. So, perhaps, in a way you could say that it's, you know, the lungs of the people that are the one's that are really paying the cost of the existing levels of pollution, and we need to do a better job of measuring it. There's no question about that. To quantify it, to try to put a monetary value on things that can be monetized. But when you get down to it, it is to some degree an issue about values, about, you know, what the public wants.

Senator SESSIONS. Well, I think we want improved health for America, and I have no doubt that the people expect us to spend their resources in the most efficient way to improve their health. That's what we're struggling with.

Thank you, Mr. Chairman.

Senator INHOFE. Ms. Nichols, I want to be sure that we don't leave that figure of $9.7 billion unchallenged in this meeting, because I have not seen anyone who has done an analysis of what they would anticipate the cost to the American people that's anywhere near that low of a figure. The Reasoner Foundation out in California came out with a range from $90 billion to $150 billion a year. Now that—this is big. It means an average family in Alabama of four would have to pay about $1,600 a year. I mean, this is big.

I also have to observe that, it kind of reminds me of something I heard a long time ago when I first got into politics. When you talk about tax increases they say, "Don't tax me. Don't tax thee. Tax that guy behind the tree." That's exactly what you guys are doing. You're saying well, this isn't going to affect the U.S. Conference of Mayors and the cities and communities. This isn't going to affect the farm, the ag community. This isn't going to affect small business, just those big, tall smokestacks out there. It just isn't true. You have to know it isn't true.

Now let me ask you as far as the statement that was made during the meeting out in California, to the U.S. Conference of Mayors—"don't worry, you're not going to be affected by this." Do you agree with that?

Ms. NICHOLS. I'm not sure what statement——

Senator INHOFE. Well, let me ask you the question. Do you think that these communities are going to be adversely affected in terms of us saying what they have to do, or telling the States to tell them what they have do to, and that is an unfunded mandate? Do you feel it's not an unfunded mandate?

Ms. NICHOLS. I am convinced that setting air quality standards is not an unfunded mandate. If the question is, is there a validity to the statement that controls on power plants are the strategy we will be pursuing, it seems to me that you have the best assurance that you can get in the form of the directive that the President sent to the Administrator, the implementation strategy that was published in the Federal Register, and the reality that from a cost-effectiveness standpoint it is the place that we should go. I think you would want us to turn to the most cost-effective strategies first, in order to attain——

Senator INHOFE. Well, politically speaking, it's more convenient to go after the big, bad guys, and that's what they always do. We're experiencing that over there with a lot of issues. But, you know, I'm trying not to use disrespectful language, but I think the most moderate I can be to characterize what you guys have been doing to the American people, I think you have been blatantly dishonest with the American people. To try to make people believe that they don't have to have any new inconveniences out there in terms of when they harvest their crop, when they run their diesel engines, and all these things and say it's just going to be found in a few smokestacks. It's just not honest.

Ms. NICHOLS. Well, Senator. You alluded earlier to the fact that I was planning to return to California and back to the private sector again, and so perhaps I could be indulged just for a moment in reminding people that being from the place in the country that has the worst air pollution in the Nation, and that has done the most and achieved the most to achieve those standards, perhaps I have a certain amount of confidence that it is possible to make huge progress and at the same time have a very successful economy as well.

I just have to say to you that I don't know how we could be more forthright in terms of our commitment to pursuing the most cost-effective strategies first when it comes to these new standards. We realize that we are setting an ambitious target. That's why we have tried to provide the time, and the road map, if you will, as to how we would hope to get there. We realize there is time involved and we want to work with you to make sure——

Senator INHOFE. Ms. Nichols, we are rapidly running out of time. We only have 7 more minutes, and I—there were some things I wanted to get to and briefly I'm just going to touch on this. An Oklahoma company, it was Citgo out there, are you familiar with the work that they have done in placing the $PM_{2.5}$ monitors in different locations in Texas, Oklahoma, and Louisiana in order to see what the results would be, and they found the following areas in violation of the new standards: a parking garage, a festival grounds, a tall grass prairie, outside a house, a beach, and the highest level was inside a building in the Tulsa Zoo. Does this surprise you?

Ms. NICHOLS. Yes it does, especially considering that the standard is an annual average standard, I'd find that somewhat surprising. I'd be happy to take a look at the report and——

Senator INHOFE. Well, I think it would probably be a good idea because you know it's not always government that is out there trying to analyze the effects.

Senator INHOFE. When you're looking at something as huge as this, it's important that we rely on, not our absence of knowledge, but knowledge that might be there. It might be produced by someone besides government. I have such a hard time accepting the fact that we are giving serious consideration to setting standards, not implementing them, telling the American people that this is going to save lives. I've kind of tracked the early deaths, the premature deaths that this Administration and that the EPA have cited, starting out with some 40,000 and edging down. The same as I have watched the costs that you have said and anticipated would be out there, and yet in the private sector we find the cost would be so much greater.

I'm disturbed because—yes, I'm from an agricultural State, we have other industries, too, but I don't have any doubt in my mind after looking at this that this is going to be a huge thing. I mean, how can you say that it's not going to affect small business if their electric rates go up somewhere between 8 and 11 percent? It does have an effect. I was going to pursue a couple of things that came out in the Agriculture Committee, but it doesn't look like we're going to have time to do that.

Let me just mention this one thing, though. I have a copy of a letter that was sent to Congressman Kucinich. I don't know Congressman Kucinich. I may not be pronouncing his name right. It was dated May 16, 1997, explaining to him that two facilities in his district would not be impacted by these standards. In that letter, and was this from the Administrator Browner? It's from Ms. Nichols. It's from you. "These counties likely would not have met the proposed new ozone or PM standards had these standards been in place during 1993–95. The most recent 3-year period for which we have complete data. However, based on current data, it is likely that nothing other than continued implementation of the 1990 Clean Air Act, plus the application of a regional control strategy"—I guess you are talking about OTAG there—"in the Eastern United States which will focus on power plants, large industry sources, and new autos will be necessary in order to meet the new ozone standards." And you end by saying, "It is not likely that either county"—two counties, this is in Ohio, I believe; is it Ohio?—"would require additional local controls in order to meet the new ozone standards." So here we are in Ohio, and they are pointed at as the one who is creating the problem for other States, and you're saying in these two areas that these two industries are not going to have to make any changes. They are not going to be involved in this.

Ms. NICHOLS. Again, Senator Inhofe, the letter refers to the OTAG modeling work as the basis for that assessment about what those counties would be doing, or what would be expected about their air, and the reason for that is that what the modeling shows is that the benefit of the NO_X controls are greater, the closer to the source that you are. So, since Ohio does have a number of the large, NO_X generating utilities that we're referring to, they will actually be getting the greatest benefit in terms of being able to reach the ozone standard in the counties in Ohio, and that was the point of the letter.

Senator INHOFE. So here's two counties in Ohio that have both an automobile manufacturing plant and an auto casting plant, and you say that they're not going to have any additional controls in those areas?

Ms. NICHOLS. These are counties, I believe, I am not certain I am reflecting this, but my recollection is that they are counties that have been in nonattainment in the past and have already implemented a number of new source review and other kinds of requirements that are in place. We're not saying those controls would go away. What we are saying is that the benefits of the control strategy for the utilities are such that we believe that that would alone bring them into attainment under the new standard as well.

I think the chemistry of this pollutant is perhaps a little counterintuitive and one of the things that we've learned over the many years that we've been controlling ozone is that this issue about how NO_X affects air quality over long distances is one that has become clearer over a period of time. But it does appear to be quite well agreed to now by all the scientists——

Senator INHOFE. Ms. Nichols, we're out of time here. I would only observe that I believe the American people are smarter, and are not going to buy into the idea that each individual is going to be exempt. It's just going to be that guy behind the tree, and I haven't

heard anything else that has come from this meeting that has convinced me otherwise.

We are out of time. I appreciate very much your being here and I wish you the best of luck in your career as it goes west.

Ms. NICHOLS. Thank you.

Senator INHOFE. Thank you.

[Whereupon, at 11:54 a.m., the subcommittee was adjourned, to reconvene at the call of the chair.]

STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Thank you Mr. Chairman for holding this important hearing on implementation issues. This is a critical area and requires careful attention from Congress.

I have been very supportive of setting standards on a health-basis using the most recent scientific evidence. EPA has weighed a large amount of data and developed the revised standards to protect public health.

I have continued to express concern about ensuring that the standards are implemented in a sensible, equitable and cost-effective manner, with full consideration of costs, and adequate time for attaining the standards. The President has committed that these standards will be implemented in a way that does not cause economic dislocations, and it is critical that regulatory agencies pay close attention to the process. The burden must be equitable. Downwind states must not bear unfair costs because pollution sources in upwind states have not been controlled adequately.

First, and most importantly, it is critical that EPA implement on an expedited basis the strategy for controlling emissions of pollutants from areas upwind of the Northeast. Downwind states are in a grossly inequitable position. Without prompt and strong followup on this commitment, EPA's promise of cleaner air in a cost-effective, equitable and effective manner will not be fulfilled. EPA's attention to the transport problem must not stop there. Its policies under both the old and new standard must recognize the transport phenomenon and ensure that areas are not unfairly penalized for being downwind of communities with massive air quality problems.

Second, I'm concerned that EPA's plan raises some equity issues between current and new nonattainment areas. These need to be addressed promptly. We also need to ensure that EPA has not unduly loosened requirements in areas that contribute to downwind pollution.

Third, we need to pay close attention to ensure that the timeframe for implementation is adequate.

Fourth, we need to examine how EPA has applied some of the requirements of the old standard in the context of the new standard and whether that approach makes sense.

These are just some of the issues that need to be addressed during the implementation process. There is considerable dispute about costs of implementation which ultimately will be determined during the implementation process. Concern about costs underscores the need for paying close attention to implementation.

STATEMENT OF HON. MAX BAUCUS, U.S. SENATOR FROM THE STATE OF MONTANA

Senator Inhofe, I'd like to start by thanking you for convening this hearing. And I'd also like to thank Assistant Administrator Mary Nichols for her testimony today.

Since EPA released its proposal for new ozone and $PM_{2.5}$ standards, we have heard from just about everyone interested in this issue. Scientists, industry, farmers and ranchers, environmentalists, health professionals and State and local governments. And EPA has also received over 50,000 comments both pro and con.

Those comments have shown that while clean air is neither easy nor inexpensive, the importance of protecting public health cannot be shown on a balance sheet. The fact remains that air pollution has costly impacts on our workforce, health care system, environment, and our quality of life.

Exposure to ozone makes breathing difficult for the young and the old. Furthermore, particulate emissions are causing people to die prematurely. And, although we don't have all the answers, we need to take action now to improve the quality of our nation's air.

But despite the great importance of this issue or maybe because of it we have had difficulty talking calmly and thoughtfully about how to get the clean air our citizens want in a way that makes sense for our local economies. For instance, this Spring

there was great hysteria among folks who were told that the EPA was preparing to snuff out their barbecues. This summer farmers in my State of Montana were told that the EPA was going to force them to change the way they do their jobs. But Administrator Browner has assured us on the record that neither of these things are true.

In addition, the Administrator responded to our concerns about implementing these new standards. EPA's strategy will give areas more time to meet the new standards. It creates a program to deal with the ozone transport problem helping many downwind areas meet the new standard without having to adopt any new controls. And it sets up a monitoring system that will help scientists answer some of the questions about fine particles that have generated so much debate.

EPA predicts that by achieving the new $PM_{2.5}$ standard, premature deaths will be reduced by 38 percent each year. That is an impressive statistic. But no lives will be saved if states can't meet the new standards. It's time to put the last several months behind us and get on with the job at hand. Namely, helping EPA and the states identify the most sensible, cost-effective ways to implement these new standards.

So, Mr. Chairman, I look forward to Ms. Nichols' testimony and today's discussion about how we will proceed in implementing these new standards. I believe that EPA is headed in the right direction. It is this Committee's responsibility to ensure that happens, and I look forward to working with the Administration to be sure it does. We must implement these standards in a way that makes sense for our economy and provides cleaner air for all Americans.

Thank you Mr. Chairman.

PREPARED STATEMENT OF MARY D. NICHOLS, ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY

Mr. Chairman, Members of the Subcommittee, thank you for inviting me to discuss implementation plans for the Environmental Protection Agency's (EPA's) revisions to the national ambient air quality standards for ground-level ozone and particulate matter.

As you know, the Clean Air Act directs EPA to set national standards for certain air pollutants to protect public health and the environment. For each of these pollutants, Congress directed EPA to set what are known as "primary" standards to protect public health without consideration of cost and "secondary" standards to protect public welfare, including the environment, crops, vegetation, and so forth for which costs may be considered. Under the Act, Congress directs EPA to review these standards every 5 years to determine whether the latest scientific research indicates a need to revise them.

Last week, EPA set new standards for ozone and particulate matter that will be a major step forward in public health and welfare protection. Each year, these updated standards have the potential to prevent as many as 15,000 premature deaths; as many as 350,000 cases of aggravated asthma; and as many as one million cases of significantly decreased lung function in children.

Numerous other public health and welfare benefits will result from implementation of the new standards. Additional public health benefits would include: reduced respiratory illnesses, reduced acute health effects, reduced cancer from air toxics reductions, and the avoidance of various other air pollution-related illnesses and health effects. Public welfare benefits will include: reduced adverse effects on vegetation, forests, and natural ecosystems, improved visibility, and protection of sensitive waterways and estuaries from deposition of airborne nitrogen that can cause algal blooms, fish kills, and loss of aquatic vegetation. Estimated total monetized health and public welfare benefits associated with the new standards are enormous, ranging in the tens of billions of dollars annually. Many additional potentially large benefit categories, such as reduced chronic respiratory damage, infant mortality, and other health and welfare benefit categories, cannot be monetized.

The new ozone and particulate matter standards are based on an extensive scientific and public review process. Congress directs EPA to consult with an independent scientific advisory board, the Clean Air Scientific Advisory Committee (CASAC). In conducting these reviews, EPA analyzed thousands of peer-reviewed scientific studies that had been published in well-respected scientific journals. These studies were then synthesized, along with a recommendation on whether the existing standards were adequately protective, and presented to CASAC. After 3½ years of work, 11 CASAC meetings totaling more than 125 hours of public discussion, and based on 250 of the most relevant studies, the CASAC panel concluded that EPA's air quality standards for ozone and particulate matter should be revised. CASAC sup-

ported changing the ozone standards from a 1-hour averaging period to an 8-hour average to reflect increasing concern over prolonged exposure to ozone, particularly in children. CASAC also supported adding a fine particle standard. Fine particles are inhaled more deeply into the lungs.

EPA then proposed updated standards and conducted an extensive public comment process, receiving approximately 57,000 comments at public hearings across the country and through written, telephone and E-mail message communications.

As a result of this extensive process, the final standard for ozone will be updated from 0.12 parts per million (ppm) of ozone measured over 1 hour to a standard of 0.08 ppm measured over 8 hours, with the 3-year average of the annual fourth highest concentrations determining whether an area is out of compliance. The new standard also reduces "flip-flopping" in and out of attainment by changing it from an "expected exceedance" to a "concentration-based" form. For particulate matter, EPA is adding new standards for particles smaller than 2.5 micrometers in diameter (known as $PM_{2.5}$ or fine particles). The fine particle standard will have two components: an annual standard, set at 15 micrograms per cubic meter and a 24-hour standard, set at 65 micrograms per cubic meter. EPA has also changed the form of the current 24-hour PM_{10} standard; this will provide some additional stability and flexibility to states in meeting that standard.

We believe it is critical to move forward with these standards now. The American public deserves to know whether its air is healthy or not. The standards we have set serve as an essential benchmark for people to use in understanding whether the air they are breathing is safe. In addition, the standards will encourage early action to help reduce adverse health effects as soon as possible. By setting the standards now, states will be able to proceed with the monitoring and planning requirements needed for implementing them over the next several years. For $PM_{2.5}$, areas can begin to develop inventories and characterize the nature of their $PM_{2.5}$ problem. As I will now discuss, we have developed an implementation strategy through an extensive interagency consultative process to assure that concerns of State and local governments and affected industries, such as transportation and agriculture, are addressed. This strategy will allow states and local areas the time they need to implement these standards in a cost-effective and reasonable way.

IMPLEMENTATION OF THE REVISED AIR STANDARDS

In the interagency process leading up to the issuance of these standards, EPA worked with other Federal agencies to develop an implementation strategy for implementing the standards. In a memorandum signed July 16, 1997, President Clinton set forth several general principles for implementing the standards, and directed EPA to follow the interagency implementation strategy. I would like to summarize the principal features of that strategy for you today.

Achieving the air quality benefits of the updated standards requires a flexible, common sense, cost-effective means for communities and businesses to meet the standards. The President's implementation package has four basic features, all of which can be carried out under existing legal authority:

1. Implementation of the air quality standards is to be carried out to maximize common sense, flexibility, and cost effectiveness;

2. Implementation shall ensure that the Nation continues its progress toward cleaner air by respecting the agreements already made by States, communities, and businesses to clean up the air, and by avoiding additional burdens with respect to the beneficial measures already underway in many areas. Implementation also shall be structured to reward State and local governments that take early action to provide clean air to their residents; and to respond to the fact that pollution travels hundreds of miles and crosses many State lines;

3. Implementation shall ensure that the Environmental Protection Agency ('Agency') completes its next periodic review of particulate matter, including review by the Clean Air Scientific Advisory Committee, within 5 years of issuance of the new standards, as contemplated by the Clean Air Act. Thus, by July 2002, the Agency will have determined, based on data available from its review, whether to revise or maintain the standards. This determination will have been made before any areas have been designated as 'nonattainment' under the $PM_{2.5}$ standards and before imposition of any new controls related to the $PM_{2.5}$ standards; and

4. Implementation is to be accomplished with the minimum amount of paperwork and shall seek to reduce current paperwork requirements wherever possible."

STRATEGY FOR MEETING THE REVISED OZONE STANDARD

Ozone is a pollutant that travels great distances and it is increasingly important to address it as a regional problem. For the past 2 years, EPA has been working

with the 37 most eastern states through the Ozone Transport Assessment Group (OTAG) in the belief that reducing interstate pollution will help *all* areas in the OTAG region attain the NAAQS. A regional approach can reduce compliance costs and allow areas to avoid most traditional nonattainment planning requirements. The OTAG was an effort sponsored by the Environmental Council of States, with the objective of assessing ozone transport and recommending strategies for mitigating interstate pollution.

The OTAG completed its work in June 1997 and forwarded recommendations to EPA. Based on these recommendations, in September 1997, EPA will propose a rule requiring states in the OTAG region that are significantly contributing to nonattainment, or interfering with maintenance of attainment, in downwind states to submit State implementation plans (SIPs) to reduce their interstate pollution. EPA will issue the final rule by September 1998.

If the states choose to establish a voluntary regional emission cap and trade system, similar to the current acid rain program, reductions can be at a lower cost. EPA will encourage and assist the states to develop and implement a NO_X cap and trade program. Most important, based on EPA's review of the latest modeling, a regional approach, coupled with the implementation of other already existing State and Federal Clean Air Act requirements, will allow the vast majority of areas that currently meet the 1-hour standard but would not otherwise meet the new 8-hour standard to achieve healthful air quality without additional local controls.

Areas in the OTAG region that would still exceed the new standard after the regional strategy, including areas that do not meet the current 1-hour standard, will benefit as well, because the regional NO_X program will reduce the extent of additional local measures needed to achieve the 8-hour standard. In many cases these regional reductions may be adequate to meet CAA progress requirements for a number of years, allowing areas to defer additional local controls.

PHASE-OUT OF 1-HOUR OZONE STANDARDS

EPA's revised ozone standard will replace the current 1-hour standard with an 8-hour standard. However, the 1-hour standard will continue to apply to areas not attaining it for an interim period to ensure an effective transition to the new 8-hour standard.

As you know, the Clean Air Act includes provisions (Subpart 2 of part D of Title I) that address requirements for different nonattainment areas that do not meet the 1-hour standard (i.e., those classified as marginal, moderate, serious, severe and extreme). These requirements include such items as mandatory control measures, annual rate of progress requirements for emission reductions and emission offset requirements. All of these requirements have contributed significantly to the improvements in air quality since 1990. Although EPA initially proposed an interpretation of the Clean Air Act that would have been more flexible in how these provisions applied to existing ozone nonattainment areas after promulgation of a new ozone standard, based on comments received, EPA has reconsidered its interpretation and EPA has concluded that these provisions should continue to apply as a matter of law for the purpose of achieving attainment of the 1-hour standard. Once an area attains the 1-hour standard, those provisions and the 1-hour standard will no longer apply to that area. An area's implementation of the new 8-hour standard would then be governed only by the provisions of Subpart 1 of Part D of Title I.

The purpose of retaining the current standard is to ensure a smooth legal and practical transition to the new standard. It is important not to disrupt the controls that are currently in place as well as those that are underway to meet the current ozone standard. These controls will continue to be important to reach the new 8-hour standard.

GENERAL TIME LINE FOR MEETING THE OZONE STANDARD

Following promulgation of a revised NAAQS, the Clean Air Act provides up to 3 years for State Governors to recommend and EPA to designate areas according to their most recent air quality. In addition, states will have up to 3 years from designation to develop and submit SIPs to provide for attainment of the new standard. Under this approach, areas would be designated as nonattainment for the 8-hour standard by 2000 and would submit their nonattainment SIP by 2003. The Act allows up to 10 years plus two 1-year extensions from the date of designation for areas to attain the revised NAAQS.

TRANSITIONAL CLASSIFICATION

For areas that attain the 1-hour standard but not the new 8-hour standard, EPA will follow a flexible implementation approach that encourages cleaner air sooner,

responds to the fact that ozone is a regional as well as local problem, and eliminates unnecessary planning and regulatory burdens for State and local governments. A primary element of the plan will be the establishment under Section 172(a)(1) of the CAA of a special "transitional" classification for areas that participate in a regional strategy and/or that opt to submit early plans addressing the new 8-hour standard. Because many areas will need little or no additional new local emission reductions to reach attainment, beyond those reductions that will be achieved through the regional control strategy, and will come into attainment earlier than otherwise required, EPA will exercise its discretion under the law to eliminate unnecessary local planning requirements for such areas. EPA will revise its rules for new source review (NSR) and conformity so that states will be able to comply with only minor revisions to their existing programs in areas classified as transitional. During this rulemaking, EPA will also reexamine the NSR requirements applicable to existing nonattainment areas, in order to deal with issues of fairness among existing and new nonattainment areas. The transitional classification would be available for any area attaining the 1-hour standard but not attaining the 8-hour standard as of the time EPA promulgates designations for the 8-hour standard. In terms of process, areas would follow the approaches described below based on their status.

(1) Areas attaining the 1-hour standard, but not attaining the 8-hour standard, that would attain the 8-hour standard through the implementation of the regional NO_X transport strategy for the East.

Based on the OTAG analyses, areas in the OTAG region that would reach attainment through implementation of the regional transport strategy would not be required to adopt and implement additional local measures. When EPA designates these areas under section 107(d), it will place them in the new transitional classification if they would attain the standard through implementation of the regional transport strategy and are in a State that by 2000 submits an implementation plan that includes control measures to achieve the emission reductions required by EPA's rule for states in the OTAG region. This is 3 years earlier than an attainment SIP would otherwise be required. We anticipate that we will be able to determine whether such areas will attain the revised ozone standard based on the OTAG and other regional modeling and that no additional local modeling would be required.

(2) Areas attaining the 1-hour standard but not attaining the 8-hour standard for which a regional transport strategy is not sufficient for attainment of the 8-hour standard.

To encourage early planning and attainment for the 8-hour standard, EPA will make the transitional classification available to areas not attaining the 8-hour standard that will need additional local measures beyond the regional transport strategy, as well as to areas that are not affected by the regional transport strategy, provided they meet certain criteria. To receive the transitional classification, these areas must submit an attainment SIP prior to the designation and classification process in 2000. The SIP must demonstrate attainment of the 8-hour standard and provide for the implementation of the necessary emissions reductions on the same time schedule as the regional transport reductions.

(3) Areas not attaining the 1-hour standard and not attaining the 8-hour standard.

The majority of areas not attaining the 1-hour standard have made substantial progress in evaluating their air quality problems and developing plans to reduce emissions of ozone-causing pollutants. These areas would be eligible for the transitional classification provided that they attain the 1-hour standard by the year 2000 and comply with EPA's regional transport rule, as applicable.

AREAS NOT ELIGIBLE FOR THE TRANSITIONAL CLASSIFICATION

Existing nonattainment areas which cannot attain the 1-hour standards by 2000 will not be eligible for the transitional classification. However, their work on planning and control programs to meet the 1-hour standard by their current attainment date will take them a long way toward meeting the 8-hour standard. While areas will need to submit an implementation plan for achieving the 8-hour standard within 3 years of designation as nonattainment for the new standard, such a plan can rely in large part on measures needed to attain the 1-hour standard. For virtually all of these areas, no additional local control measures beyond those needed to meet the requirements of Subpart 2 and needed in response to the regional transport strategy would be required to be implemented prior to their applicable attainment date for the 1-hour standard. This approach allows them to make continued progress toward attaining the 8-hour standard throughout the entire period without requiring new additional local controls for attaining the 8-hour standard until the 1-hour standard is attained.

IMPLEMENTING THE NEW PARTICULATE MATTER STANDARDS

Implementing the new particulate matter standards will require a different path from the one I just discussed for ozone. As required under the Act, within the next 5 years EPA will complete the next periodic review of the particulate matter criteria and standards, including review by the CASAC. As with all NAAQS reviews, the purpose is to update the pertinent scientific and technical information and to determine whether it is appropriate to revise the standards in order to protect the public health with an adequate margin of safety or to protect the public welfare. EPA has concluded that the current scientific knowledge provides a strong basis for the revised PM_{10} and new $PM_{2.5}$ standards. We, along with the Departments of Transportation, Health and Human Services, Labor, and others, will continue to sponsor research to better understand the causes and mechanisms, as well as the effects of fine particles on human health, and the species and sources of $PM_{2.5}$. EPA will also promptly initiate a new review of the scientific criteria on the effects of airborne particles on human health and the environment. By July 2002, we will have determined, based on data available from its review, whether to revise or maintain the standards. This determination will have been made before any areas have been designated nonattainment under the $PM_{2.5}$ standards and before imposition of any new controls related to the $PM_{2.5}$ standards.

IMPLEMENTATION OF NEW $PM_{2.5}$ NAAQS

The first priority for implementing the new $PM_{2.5}$ standard is establishing a comprehensive monitoring network to determine ambient fine particle concentrations across the country. The monitoring network will help EPA and the states determine which areas do not meet the new air quality standards, what the major sources of $PM_{2.5}$ in various regions are, and what action is needed to clean up the air. EPA and the states will consult with affected stakeholders on the design of the network and will then establish the network, which will consist of approximately 1,500 monitors. All monitors will provide for limited "speciation," or analysis of the chemical composition, of the particles measured. At least 50 of the monitors will provide for a more comprehensive speciation of the particles. EPA will work with states to deploy the $PM_{2.5}$ monitoring network. Based on the ambient monitoring data we have seen to date, these would generally not include agricultural areas. The EPA will fund the cost of purchasing the monitors, as well as the cost of analyzing particles collected at the monitors to determine their chemical composition.

Because we are establishing standards for a new indicator for particulate matter (i.e., $PM_{2.5}$), it is critical to develop the best information possible before attainment and nonattainment designation decisions are made. Three calendar years of monitoring data that complies with EPA's monitoring requirements will be used to determine whether areas meet or do not meet the $PM_{2.5}$ standards. Three years of data will be available from the earliest monitors in the spring of 2001, and 3 years of data will be available from all monitors in 2004. Following this monitoring schedule and allowing time for data analysis, Governors and EPA will not be able to make the first determinations as to which areas should be designated nonattainment until at least 2002, 5 years from now. The Clean Air Act, however, requires that EPA make designation determinations (i.e., attainment, nonattainment, or unclassifiable) within 2 to 3 years of revising a NAAQS. To fulfill this requirement, in 1999 EPA will issue "unclassifiable" designations for $PM_{2.5}$. These designations will not trigger the nonattainment planning or control requirements of Title I of the Act.

When EPA designates nonattainment areas for $PM_{2.5}$ pursuant to the Governors' recommendations beginning in 2002, areas will be allowed 3 years to develop and submit to EPA pollution control plans showing how they will meet the new standards. As for ozone, areas will have up to 10 years from the date of being redesignated as nonattainment until they will have to attain the $PM_{2.5}$ standards. In addition, two 1-year extensions are possible.

In developing strategies for attaining the $PM_{2.5}$ standards, it will be important to focus on measures that decrease emissions that contribute to regional pollution. Available information indicates that nearly one-third of the areas projected to not meet the new $PM_{2.5}$ standards, primarily in the Eastern United States, could come into compliance as a result of the regional SO_2 emission reductions already mandated under the Clean Air Act's acid rain program, which will be fully implemented between 2000 and 2010. Similarly, the Grand Canyon Visibility Transport Commission, consisting of western states and tribes, committed to reductions in regional emissions of $PM_{2.5}$ precursors (sulfates, nitrates, and organics) to improve visibility across the Colorado Plateau.

As detailed $PM_{2.5}$ air quality data and data on the chemical composition of $PM_{2.5}$ in different areas become available, EPA will work with the states to analyze regional strategies that could reduce $PM_{2.5}$ levels. If further cost-effective regional reductions help areas meet the new standard, EPA will encourage states to work together to use a cap and trade approach similar to that used to curb acid rain. The acid rain program delivered environmental benefits at a greatly reduced cost.

Given the regional dimensions of the $PM_{2.5}$ problem, local governments and local businesses should not be required to undertake unnecessary planning and local regulatory measures when the problem requires action on a regional basis. Therefore, as long as the states are doing their part to carry out regional reduction programs, the areas that would attain the $PM_{2.5}$ standards based on full implementation of the acid rain program will not face new local requirements. Early identification of other regional strategies could also assist local areas in completing their programs to attain the $PM_{2.5}$ standards after those areas have been designated nonattainment.

The EPA will also encourage states to coordinate their $PM_{2.5}$ control strategy development and efforts to protect regional visibility. Visibility monitoring and data analysis will support both $PM_{2.5}$ implementation and the visibility program.

IMPLEMENTATION OF REVISED PM_{10} NAAQS

In its rule, EPA is revising the current set of PM_{10} standards. Given that health effects from coarse particles are still of concern, the overall goal during this transition period is to ensure that PM_{10} control measures remain in place to maintain the progress that has been achieved toward attainment of the current PM_{10} NAAQS (and which provides benefits for $PM_{2.5}$) and protection of public health. To ensure that this goal is met, the existing PM_{10} NAAQS will continue to apply until actions by EPA, and by states and local agencies, are taken to sustain the progress already made.

COST-EFFECTIVE IMPLEMENTATION STRATEGIES

Consistent with states' ultimate responsibility to attain the standards, EPA will encourage the states to design strategies for attaining the particulate matter and ozone standards that focus on getting low cost reductions and limiting the cost of control to under $10,000 per ton for all sources. Market-based strategies can be used to reduce compliance costs. EPA will encourage the use of concepts such as a Clean Air Investment Fund, which would allow sources facing control costs higher than $10,000 a ton for any of these pollutants to pay a set annual amount per ton to fund cost-effective emissions reductions from non-traditional and small sources. Compliance strategies like this will likely lower the costs of attaining the standards through more efficient allocation, minimize the regulatory burden for small and large pollution sources, and serve to stimulate technology innovation as well.

FUTURE ACTIVITIES

In accordance with the President's July 16 directive, to ensure that the final details of the implementation strategy are practical, incorporate common sense, and provide for appropriate steps toward cleaning the air, input is needed from many stakeholders including representatives of State and local governments, industry, environmental groups, and Federal agencies. EPA will continue seeking advice from a range of stakeholders and, after evaluating their input, propose the necessary guidance to make these approaches work. In particular, EPA will continue working with the Subcommittee on Implementation of Ozone, Particulate Matter and Regional Haze Rules which EPA established to help develop innovative, flexible and cost-effective implementation strategies. Moreover, EPA will continue to work with a number of Federal agencies to ensure that those agencies comply with these new standards in cost-effective, common sense ways. EPA plans to issue all guidance and rules necessary for this implementation strategy by the end of 1998.

EPA will continue to work with the Small Business Administration (SBA) because small businesses are particularly concerned about the potential impact resulting from future control measures to meet the revised PM and ozone standards. EPA, in partnership with SBA, will work with the states to include in their SIPs flexible regulatory alternatives which minimize the economic impact and paperwork burden on small businesses to the greatest possible degree consistent with public health protection.

CONCLUSIONS

In summary, EPA believes that the new ozone and particulate matter standards will provide important new health protection and will improve the lives of Ameri-

cans in coming years. Our implementation strategy will ensure that these new standards are implemented in a common sense, cost-effective and flexible manner. We intend to work closely with State and local governments, other Federal agencies and all other interested parties to accomplish this goal.

Mr. Chairman, this concludes my written statement. I will be happy to answer any questions that you might have.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

NOV 21 1997

OFFICE OF
AIR AND RADIATION

The Honorable James M. Inhofe
Chairman
Subcommittee on Clean Air, Wetlands,
Private Property, and Nuclear Safety
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

Enclosed, for insertion into the hearing record, are the Environmental Protection Agency's (EPA) responses to follow-up questions from the July 24, 1997 hearing before the Subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety on EPA's ozone and particulate matter standards. I hope this information will be useful to you and Members of the Subcommittee.

Thank you for providing EPA the opportunity to testify on this important issue.

Sincerely,

Robert D. Brenner (for)

Richard D. Wilson
Acting Assistant Administrator
for Air and Radiation

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EPA'S RESPONSES TO FOLLOW-UP QUESTIONS FROM THE JULY 24, 1997 HEARING BEFORE THE SUBCOMMITTEE ON CLEAN AIR, WETLANDS, PRIVATE PROPERTY, AND NUCLEAR SAFETY OF THE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

EPA'S RESPONSES TO QUESTIONS FROM CHAIRMAN JAMES M. INHOFE

Question 1:

Please cite and explain the legal authority for the following aspects of the EPA's implementation policy.

- The Cap and Trade emissions program for utilities.
- The transitional classification system.
- Maintaining two different ozone standards simultaneously.

Answer:

Cap and Trade. Section 110(a)(2)(D) of the Clean Air Act ("Act" or "CAA") requires state implementation plans (SIPs) to prohibit emission activities that "contribute significantly to nonattainment in, or interfere in maintenance by, any other State" of a national ambient air quality standard (NAAQS) . On October 10, 1997, EPA proposed a rulemaking that would require numerous States in the eastern half of the United States to submit to EPA SIP revisions containing controls to reduce NOx emissions which have been proven to cross state boundaries and which are contributing significantly to downwind violations of the ozone standard. EPA is authorized to require these SIP revisions to implement the 1-hour ozone standard, under CAA section 110(k)(5), which may be termed the "SIP call" provision. Through this SIP call, EPA would find current SIPs for the 1-hour ozone standard to be inadequate to address the NOx contribution their sources are making, and EPA would mandate additional NOx controls. In addition, EPA will also propose that under the new ozone standard, SIPs will need to address this provision by providing for the specified NOx reductions. EPA has the authority under CAA section 110(a)(1) to require these types of SIP revisions under the new ozone standard. While EPA would be requiring these States to achieve a specified amount of reductions in NOx emissions, EPA would mandate neither the type of sources that the State must control nor the emission reductions program that the State must use to provide for these reductions. However, EPA would encourage States to use a market system, such as a cap-and-trade program, because those programs have been demonstrated to achieve emission reductions in a very cost-effective manner. Section 110(a)(2)(A) of the Act authorizes SIPs to include such measures "including economic incentives such as fees, marketable permits, and auctions of emissions rights" as may be necessary or appropriate to meet the applicable requirements. This language would authorize cap-and-trade programs to meet obligations under section 110(a)(2)(D). In addition, if the States fail to respond appropriately to the requirements to submit SIP revisions, under section

110(c)(1), EPA ultimately would be required to promulgate a Federal implementation plan for the State. At present, EPA intends to promulgate a cap-and-trade program in the event EPA is obligated to promulgate a Federal implementation plan. EPA is authorized to employ such methods because, in promulgating a Federal plan, EPA may avail itself of authority that the Act grants States, such as that provided by section 110(a)(2)(A).

In addition, EPA has received petitions from eight northeastern States requesting EPA to make a finding under CAA section 126 that stationary sources in the midwest, southeast, mid-Atlantic, and northeast are contributing significantly to ozone problems in those eight States through NOx emissions. If EPA grants these petitions, EPA would be obligated to promulgate controls on the NOx sources found to be significant contributors. EPA anticipates that, if it grants the petitions, it would promulgate a cap-and-trade program to implement any required controls.

Transitional Classification. As part of the Administration's approach to implementing the new 8-hour standard, EPA will create a "transitional" classification for certain nonattainment areas. Section 172(a) provides EPA with the discretion to create classifications for areas designated nonattainment. Classifications may be created for the purpose of establishing attainment dates or for "other purposes." Areas that have attained the 1-hour standard but that have air quality that violates the 8-hour standard will be eligible for this classification if, prior to designation and classification, they submit the programs necessary to demonstrate attainment of the 8-hour standard.

Two Standards. In 1990, Congress added subpart 2 of part D of Title I to the Clean Air Act. These provisions contained detailed planning requirements for areas that were not in attainment of the current 1-hour 0.12 ppm ozone standard. As EPA interprets the Act, the detailed provisions of subpart 2 do not apply to the implementation of the new, 8-hour 0.08 ppm standard. Rather, the provisions of subpart 1 of part D of Title I of the Act apply to the implementation of the new 8-hour standard. However, the provisions of subpart 2 continue to apply as a matter of law for so long as an area is not attaining the 1-hour standard. Once an area attains the 1-hour standard, the purpose of the provisions of subpart 2 will have been achieved and those provisions will no longer apply.

To facilitate the implementation of subpart 2 and to ensure a smooth transition to the implementation of the new 8-hour standard, the Administrator decided that the 1-hour standard should remain applicable to areas that have not yet attained the 1-hour standard. Accordingly, the final rule establishing the new 8-hour ozone standard provides that the 1-hour standard remains applicable to an area until EPA determines that the area has attained the 1-hour standard, at which point the 1-hour standard will no longer apply to that area. EPA believes that authority to establish a smooth transition between the old and new standards by setting appropriate effective dates for the revocation of the 1-hour standard for the reasons described above is inherent in the Agency's authority in subpart 2 and sections 109 and 301 of the Clean Air Act.

Question 2:

Ms. Nichols, both you and Administrator Browner have cited the figure 5% in estimating the emissions contribution from agriculture sources, but this does not take into account indirect impacts such as increased utility costs, diesel emissions, fertilizer and chemical sources, unpaved roads, and organic and ammonia sources. Please provide a cost estimate for these impacts on the agriculture community, assuming that the States will indeed require these specific controls.

Answer:

EPA's "Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule (RIA)" provides national cost estimates associated with implementation of the new standards. While we believe the models employed yield reasonable estimates of national costs, industry-specific impacts could not be reliably estimated with these models. Moreover, since the actual implementation strategy that States will employ is unknown, the RIA assessed just one of many possible implementation approaches. Thus the actual industry-specific impacts associated with future implementation of the NAAQS are difficult to estimate at this time.

Nevertheless, Appendix H of the RIA provides rough industry-specific potential economic impact estimates associated with the new standards for one potential implementation scenario (a copy of the RIA is enclosed). Potential impacts on various agriculture-related industries are presented in this appendix. However, the models employed in the RIA are not capable of estimating indirect economic impacts on the agriculture community from controls on other sectors. Thus we do not have indirect economic impact estimates on the agriculture community at this time.

Note that we did not assess controls on organic and ammonia sources in the RIA. We do not expect States to focus control efforts on these emission sources. Ammonia is not a limiting factor in $PM_{2.5}$ formation.

Question 3:

Both you (at a Senate briefing) and Administrator Browner (at the Agriculture Committee Hearing) have made public statements regarding the availability of the so called Harvard data. You have both maintained that the data is now available to <u>ANY</u> scientist through the Health Effects Institute (HEI). These statements totally contradict statements made by HEI in the enclosed letter. Would you please explain the process for the review of the disputed data including its availability to the scientific community. Please bear in mind that the disputed data is greater than just the individual health records of patients.

Answer:

The HEI has recently begun a process to reanalyze data collected under Harvard's Six City Study and reported in a cross sectional mortality paper by Dockery et al. (1993) [1]. The process was initiated at a workshop held in Boston last June 23 that was open to the public. At that workshop, interested scientists were encouraged to raise scientific and analytical issues for the HEI Expert Panel and Analytic Team to consider in structuring their reanalyses. The current schedule for this work calls for an analytic plan to be finalized by the end of 1997, with all analyses to be completed, reviewed and published by the end of June 1999.

Much of the data used in this study were taken from publicly available data bases (*e.g.*, mortality data) or from data bases that Harvard researchers have agreed to make available to interested researchers (*e.g.*, air quality data). However, EPA is not presently aware of any plans to allow access to the complete range of Harvard data by the broader scientific community, due largely to concerns regarding Harvard's confidentiality agreements with study participants. Nonetheless, EPA continues to believe that the HEI reanalyses will serve to further buttress our confidence in this study and is encouraged by the broad interest and involvement of scientists in the reanalyses.

Question 4:

The Interagency Implementation Plan references $10,000 per ton of emission reduction as the high end of reasonable costs to impose on sources. What specific control measures fall below this cut-off and which are above?

Answer:

Appendix B of the "Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule (RIA)" provides detailed information regarding the control measures employed in the RIA (copy enclosed). Dollars per ton of PM or ozone precursor emission reduction estimates for each control measure are provided in this appendix. Please note that for some control measures, cost per ton estimates are highly uncertain.

Question 5:

Please provide for the record the recent modeling and the EPA review cited in the Interim Implementation Plan that supports the statement that a regional approach coupled with implementation of existing CAA requirements should allow "the vast majority of areas that

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[1]Dockery C.W., *et al.* 1993, "An Association Between Air Pollution and Mortality in Six U.S. Cities," *N. Engl. J. Med.* 329:1753-59.

currently meet the one hour ozone standard but would not meet the new eight hour standard to achieve healthful air quality without additional local controls."

Answer:

The statement that a regional approach coupled with implementation of existing CAA requirements should allow "the vast majority of areas that currently meet the 1-hour ozone standard but would not meet the new 8-hour standard to achieve healthful air quality without additional local controls" was based on a review by EPA of modeling results from the Ozone Transport Assessment Group (OTAG), in particular, OTAG regional strategy Run 5. The controls applied in Run 5 are summarized in Attachment 1 called "Control Strategies Contained in Model Run 5 of the Ozone Transport Assessment Group."

Using the results from the OTAG Run 5 strategy, EPA has conducted an initial evaluation of air quality for the revised 8-hour, fourth maximum ozone standard based on 1993-1995 monitoring data. In this evaluation, EPA applied the predicted ozone reductions from Run 5 to these ambient monitoring data to estimate the expected number of areas that would achieve healthful air quality in the future, if this strategy were implemented. The results of EPA's preliminary analysis of the OTAG information indicates that of the 106 new counties in the OTAG region that attain the current ozone standard, but would not attain the revised standard, 100 would likely be brought into attainment as a result of the OTAG Run 5 strategy. This information should be considered with two caveats. First, the number of new counties that will not attain the revised standard may be higher or lower than 106 because when the designations occur in 2000 they will be based on air quality data from 1997-99 and not 1993-95. Second, the number of areas that benefit from a regional NOx reduction strategy may be higher or lower depending on the extent that controls in Run 5 are adopted and implemented across the OTAG region. When EPA's NOX reduction strategy is finalized, EPA will make available estimates of the number of areas which are expected to attain as a result of this strategy.

Question 6:

Would a new facility being built or an existing facility were being expanded next year in an area that meets the one-hour standard, but is projected not to meet the new eight-hour standard require any new controls that would not have been required last year? If the answer is no, please explain whether States would require such controls or if EPA would recommend that the States require such controls.

Answer:

A projection indicating that an area would not meet the new 8-hour standard would suggest that the area ultimately may be formally designated nonattainment for ozone, but EPA does not expect to promulgate new area designations with regard to the 8-hour standard until the year 2000. Prior to an area's designation as nonattainment for ozone and the

determination that nonattainment new source review requirements apply, a facility being built or expanded in the area would be subject to the existing requirements of the prevention of significant deterioration (PSD) program if the facility or the expansion would have the potential to emit ozone precursors in amounts large enough to meet the applicable definitions of major source or major modification. As established by the CAA, the PSD program is designed to prevent the construction of major sources or major modifications from significantly deteriorating an attainment area's air quality. Under the PSD program, if air quality monitors in an area currently attaining the 1-hour ozone standard indicated that construction of a major source or a major modification would cause or contribute to a violation of the 8-hour standard, the State (or in the case of State default, EPA) would ensure, in issuing a PSD permit to the new or expanded source, that the source's emissions are mitigated to the point that the source would not contribute to a violation. How a source's emissions would be mitigated would be up to the source and the State (where the State is the permitting authority). EPA's regulations do not prescribe any specific means of mitigation (e.g., additional controls).

Question 7:

The Clean Air Act specifies categories of nonattainment as moderate, serious, severe, etc based on the .12 standard. Does the EPA plan to use these categories for the new standard? If so do you believe you have the authority to do so without amending the Clean Air Act?

Answer:

Section 181(a) of the Clean Air Act specifies the applicable classifications for areas designated nonattainment for the 1-hour 0.12 ppm ozone standard. The five specified classifications are: marginal, moderate, serious, severe and extreme. Section 181 is contained in subpart 2 of part D of Title I, which applies to the 1-hour .12 ppm ozone standard. Subpart 1, which contains section 172(a), applies to the new 8-hour ozone standard. Section 172(a) provides authority for EPA to classify areas designated nonattainment for the 8-hour 0.08 ppm ozone standard. This provision does not mandate the creation of specific categories or labels that would apply to designated areas if EPA exercised its discretion to classify under this provision. Therefore, operating under this statutory provision, for purposes of the 8-hour standard, EPA may choose to use a classification scheme similar to that for the 1-hour standard, to develop an alternative classification scheme, or not to classify areas designated nonattainment for the 8-hour standard. Consistent with the President's directive of July 16, 1997, EPA will establish an alternative classification scheme. EPA will create at least one classification -- transitional -- for areas designated nonattainment for the 8-hour standard, using the authority and procedures in section 172(a)(1)(A) and (B). EPA has not yet determined whether to create additional classifications.

Question 8:

Will the transitional designation preclude citizens suits to force the imposition of sanctions in areas which do not meet the new standards? Will these areas be exempt from additional permitting requirements or offset requirements?

Answer:

Under the Clean Air Act, citizens can sue only to enforce the requirements established for the area or to require the Administrator of EPA to perform a non-discretionary duty or to remedy unreasonably delayed Agency action. Citizen suits cannot be used to impose additional requirements on an area. As to the imposition of sanctions, they are available where areas fail to meet plan submission or implementation requirements; sanctions do not apply because an area fails to meet an ambient air quality standard.

New and modified sources locating in nonattainment areas classified as transitional will be required to meet the permit requirements under part D of title I of the Act. EPA is now developing regulations which will spell out how the statutory provisions of part D will be met in transitional areas. In particular these regulations will take into account the fact that ozone air quality problems are often a result of the long-range transport of ozone precursors. For example, in meeting the requirements for offsets, EPA expects that sources will be able to rely upon a pool of offsets which a State may allocate from the larger set of emissions reductions generated by that State as part of the OTAG regional strategy. Control technology requirements must also be addressed; however, because of circumstances unique to transitional areas, EPA believes that use of an enhanced best available control technology (BACT) analysis in selecting a control technology for a new source could meet the statutory LAER technology requirement. As required in every BACT analysis, the most stringent emission limit and associated technology must be considered in the analysis and, if not chosen, its rejection must be supported in the administrative record. Moreover, the environmental impact of regional pollutants, such as NOx, would need to be considered in the BACT analysis. In addition, EPA is considering whether, consistent with de minimus principles, other elements, such as additional offsets, would be appropriate to further the purposes of the Clean Air Act and the goals of the implementation plan in transitional areas.

Question 9:

In stating that many areas can meet the standards with existing controls, does EPA mean they will not promulgate any new fuel requirements or expand the scope of existing requirements? If not, what does EPA expect in this area and at what cost?

Answer:

Any future consideration of additional fuel controls is likely to be driven by the need to comply with new emissions standards for vehicles or engines. As part of the Tier 2 study required under the Clean Air Act to evaluate the need for more stringent vehicle tailpipe standards, EPA will gather new data on the effect of gasoline sulfur on catalysts and vehicle emissions. The Tier 2 study will be delivered to Congress in the summer of 1998. New data will include refinery cost modeling conducted by the Department of Energy on the potential cost of gasoline sulfur control.

In regard to expansion of the scope of existing fuels programs, new nonattainment areas will not be required to use cleaner-burning reformulated gasoline. EPA is currently reviewing the options available to these new areas which may allow them to participate in the reformulated gasoline program if they so choose.

Question 10:

What percentage of the emissions are you attempting to regulate with these new standards come from power plants?

Answer:

The EPA is not specifying which source sectors must be regulated to meet the new standards. However, in most areas electric utilities represent a significant part of the man-made NOx emissions. For example, the OTAG data indicate that when emissions are projected to 2007 and current Clean Air Act requirements are applied, electric utility emissions are 32 percent of the total across the domain. The percentage for individual States can be as low as 1 percent or as high as 60 percent depending on the mix of sources in an area.

Question 11:

Based on the fact that modeling conducted during the OTAG process showed that even with 85% reductions in utility emissions in the Eastern US, numerous areas still would not achieve attainment with the OLD ozone standard, what other categories of emission sources will states have to regulate to get these areas into compliance with the new standard?

Answer:

Although many areas will be able to attain due to OTAG, OTAG is not designed to be an attainment strategy for each individual area, but rather to reduce boundary ozone emissions. The goal of OTAG is to identify and recommend a strategy to reduce transported ozone and its precursors which, in combination with other measures, will enable attainment and maintenance of the national ambient ozone standard in the OTAG region.

Besides fossil fuel-fired boilers, additional nitrogen oxides (NOx) reductions could be obtained from non-utility industrial boilers and mobile sources including nonroad vehicles. In addition to the NOx emission reduction, some metropolitan areas may have to reduce emissions of volatile organic compounds (VOC). Through the OTAG process, VOC reductions were found to be effective in dealing with local non-attainment conditions. It may be necessary in large highly polluted urban areas to require additional available control technology on more stationary and mobile VOC sources. Cap-and-trade programs which lower the overall amount of VOC in an area may also be viable.

Question 12:

Will transitional areas qualify for CMAQ funds?

Answer:

Yes. EPA's new NAAQS implementation package will classify certain new nonattainment areas as "transitional areas". The Administration's NEXTEA Bill provides that these new nonattainment areas will be eligible for CMAQ funding once they have submitted a SIP to EPA.

Question 13:

Is the EPA still planning on implementing any form of "Areas of Influence" or "Areas of Violations," (including under any other name)? What will this entail, how will it work, what type of controls are being considered?

Answer:

One of the issues which the FACA Subcommittee is reviewing and discussing in its analysis of the implementation program for the new standards is whether EPA should identify "areas of violations" and "areas of influence." Such a system would be intended to reflect the fact that pollutants can be transported long distances causing violations of the standards in the downwind areas. Since the FACA Subcommittee has not completed its work and EPA has not developed its implementation program, it is not yet possible to say how this issue will be handled. The EPA expects to include a discussion of how this issue will be handled in the final implementation materials that will be published by December 1998.

Question 14:

Explain the deadlines for: a) areas currently in nonattainment for the existing ozone standard which will also be in nonattainment for the new standard, b) areas currently in attainment for the existing ozone standard which will be in nonattainment for the new standard in

the OTAG region, and c) areas currently in attainment for the existing ozone standard which will be in nonattainment for the new standard in areas outside the OTAG region.

Answer:

On July 16, 1997 President Clinton in a memorandum to the Administrator of EPA directed that the "implementation of the air quality standards is to be carried out to maximize common sense, flexibility, and cost-effectiveness." The "Implementation Plan for the Revised Air Quality Standards," attached to the President's memorandum, outlined a schedule for action on the new standards and identified a new transitional classification for nonattainment areas. Based on the recommendations of OTAG, EPA issued, on October 10, 1997, a proposed call for State implementation plan (SIP) revisions to reduce interstate pollution in those OTAG States which are significantly contributing to nonattainment or interfering with maintenance of attainment of the 1-hour and the new 8-hour ozone standards in downwind States. The EPA will finalize this action by September 1998. By July 2000, the governors of the affected States must submit their recommendations for the designation of nonattainment areas. Based on the time frames in the implementation plan, the deadline for the areas which you identified are as follows:

a) Ozone nonattainment areas for the 0.12 and 0.08 ppm standards -- These areas need to be divided into two subcategories: one for areas which attain the 1-hour standards by 2000, which would be eligible for the transitional classification (see b and c below) and one for areas which cannot attain the 1-hour standard by 2000. For the latter subcategory, their work on planning and control programs to meet the 1-hour standard by their current attainment date will take them a long way toward meeting the 8-hour standard. While any additional local reductions that they will need to achieve the 8-hour standard must occur prior to their 8-hour attainment date, for virtually all areas the additional reductions needed to achieve the 8-hour standard can occur after the 1-hour attainment date. This approach allows these areas to make continued progress toward attaining the 8-hour standard throughout the entire period without requiring new additional local controls for attaining the 8-hour standard until the 1-hour standard is attained. These areas, however, will need to submit an implementation plan for achieving the 8-hour standard within 3 years of designation as nonattainment for the new standard . Such a plan can initially rely in large part on measures needed to attain the 1-hour standard. For many of these areas, no additional local control measures beyond those needed to meet the present SIP requirements and needed in response to the regional transport strategy would be required to be implemented prior to their applicable attainment date for the 1-hour standard.

b) Ozone areas in attainment with the 1-hour standard which will be in nonattainment for the new standard in the OTAG region -- Based on the OTAG findings and recommendations on October 10, 1997, EPA proposed a rule requiring States in the OTAG region that are significantly contributing to nonattainment or interfering with maintenance of attainment in downwind States to submit SIPs to reduce their contribution to interstate pollution. The EPA will issue the final rule by September 1998. States will have approximately 1 year to develop, adopt and submit their SIP revision that includes control measures to achieve the

emission reductions required by the EPA's rule for States in the OTAG region. If an area wants to qualify for the transitional classification and more local controls measures are necessary for attainment of the 8-hour standard, the State needs to submit an attainment demonstration identifying the emission reduction measures to attain the standards and to adopt and submit a SIP revision in 2000 which requires the implementation of those measures by 2004. Areas that do not qualify for the transitional classification would have to submit a SIP revision by 2003 which demonstrates attainment of the 8-hour standard as expeditiously as practicable, but no later than the year 2010. Actual attainment of the standards could possibly be as late as 2012 if the State is able to obtain both of the 1-year extensions allowed for in the Act.

c) Ozone areas in attainment with the 1-hour standard which will be in nonattainment for the new standard not in the OTAG region -- These areas will be eligible for the transitional classification provided they submit by 2000 a SIP revision demonstrating attainment of the 8-hour standard on the same schedule as the transitional areas in the OTAG region. The Clean Air Act allows up to 10 years from the date of designation for an area to attain the 8-hour standard. As mentioned above, actual attainment could be delayed by an additional 2 years if the State obtains the extensions allowed in the Act.

Question 15:

How do you square the difference in cost estimates between the EPA figure of $9.1 billion for both standards and the President's Council of Economic Advisors estimate of $60 billion for ozone alone?

Answer:

Based on preliminary information presented by EPA in the December 1996 Regulatory Impact Analysis (RIA) for the proposed ozone standard only, CEA developed full attainment cost estimates that ranged from a low end of $11.6 billion to a high end of $60.0 billion. In the analysis of the final ozone standard, based on more complete information, EPA provided a full attainment cost estimate of $9.6 billion. Several factors account for the difference: 1) the standard that CEA analyzed using information from the December 1996 RIA was more stringent than the final rule; 2) there were differences in estimates of the emissions reductions needed to meet the standard for the final RIA; and 3) the full attainment costs presented in the final RIA reflect the assumptions that through technological progress and innovative policy mechanisms, "residual emissions" (those reductions not identified in the "partial attainment" scenario) reduced at an average of $10,000 per ton of emissions reduction is the high end of the range of reasonable cost to impose on sources. The EPA will encourage compliance strategies that will likely lower the cost of attaining the standards.

EPA'S RESPONSES TO QUESTIONS FROM SENATOR BAUCUS

Question 1:

I understand that EPA hopes to get early ozone reductions by asking the States that participated in the Ozone Transport Assessment Group (OTAG) to deal with their contribution to regional ozone transport. Obviously, if this works as planned, it would make it easier for areas impacted most by regional transport to meet the new standards. How does EPA plan to create and implement this program?

Answer:

The OTAG demonstrated that a significant reduction in NO_x emissions in the core OTAG region can have substantial benefits in reducing ozone concentrations. With these reductions, many areas in the OTAG region can attain the 8-hour standard with little or no additional local controls. Based on the recommendation of OTAG, EPA will issue in September 1997 a proposed call for State implementation plan (SIP) revisions to reduce interstate pollution in those OTAG States which are significantly contributing to nonattainment or interfering with maintenance of attainment of the ozone standard in downwind States. The EPA will finalize those calls by September 1998. The SIP revisions required by this action would be due approximately 1 year later and would need to provide for implementation of the emission reductions as expeditiously as practicable but no later than 2004. The EPA will continue to work with the State and local agencies to assist them in developing adequate SIP revisions.

Question 2:

Will EPA be able to enforce any of the requirements necessary in the OTAG States? In other words, what if one of the key States decline to participate?

Answer:

State environmental officials were part of the OTAG process and recognize the need for the required controls. The EPA expects that the States will understand that this approach provides a cost-effective way of controlling ozone and will minimize their planning burden and the need for local controls. Once EPA issues a final call for a SIP revision, the State faces a choice. It can revise its SIP, accordingly, or if it chooses not to do so then EPA must, as appropriate, impose sanctions on the State and promulgate a Federal implementation plan. In addition, areas that participate in the regional strategy and, if necessary, submit early plans addressing the new 8-hour standard will be eligible for the special transitional classification.

Question 3:

How many areas will meet the new ozone standard without further controls, other than those gained through implementation of an ozone transport program?

Answer:

The EPA has performed a preliminary analysis of the Ozone Transport Assessment Group (OTAG) information that indicates that of the 250 counties in the OTAG region that would not attain the revised standard, 209 counties would likely be brought into attainment as a result of "an ozone transport program." Of the 250 counties that would not attain the revised standard, 104 are "new" nonattainment counties located outside existing 1-hr nonattainment areas. Of these "new" counties, 102 would likely be brought into attainment as a result of "an ozone transport program". These results are based on the implementation of the regional NOx strategy analyzed by OTAG in strategy Run 5 together with implementation of existing CAA requirements. This information should be considered with two caveats. First, the number of counties that will not attain the revised standard may be higher or lower than 250 because when the designations occur in 2000 they will be based on air quality data from 1997-99 and not 1993-95. Second, the number of areas that benefit from a regional NOx reduction strategy may be higher or lower depending on the extent that controls in Run 5 are adopted and implemented across the OTAG region. When EPA's NOx reduction strategy is finalized, EPA will make available estimates of the number of areas which are expected to attain as a result of this strategy.

Question 4:

I understand that you plan to designate areas as "transitional areas" if they can't meet the new standard because they are impacted by regional ozone problems. What do you believe is your authority to create this "transitional" designation?

Answer:

Consistent with the President's directive of July 16, 1997, EPA plans to create a "transitional" classification that will be available for many areas designated nonattainment for the 8-hour 0.08 ppm ozone standard. Any area that has attained the 1-hour standard prior to the designations in July 2000 for the 8-hour standard will potentially be eligible for the classification. To receive the "transitional" classification, these areas would need to comply with the regional NOx strategy and, if additional emission reductions are needed to demonstrate attainment of the 8-hour standard, an area would need to submit a SIP providing for implementation of those additional measures no later than the required implementation of the NOx strategy measures. Section 172(a) provides EPA with the discretion to create classifications for areas designated nonattainment. Classifications may be created for the purpose of establishing attainment dates or for "other purposes."

Question 5:

Will there be any new requirements for these "transitional areas?"

Answer:

President Clinton, in a July 16, 1997 memorandum to the Administrator of EPA, directed the Agency to exercise discretion under the law to eliminate unnecessary local planning requirements for the transitional areas. He also directed the Agency to revise its rules for new source review (NSR) and conformity so that States will be able to comply with only minor revisions to their existing programs in areas classified as transitional. All necessary guidance and rulemaking must be completed by EPA by the end of 1998. The EPA expects that the transitional areas in the OTAG region will rely heavily on the regional NO_x control strategy and not on new controls on local sources for the attainment of the 8-hour standard. Under the Presidential directive, EPA will be streamlining the NSR and conformity requirements for these areas.

Question 6:

What is the incentive for these "transitional areas" to submit plans earlier than is required in areas currently in attainment for the existing ozone standard which will be in nonattainment for the new standard in the OTAG region?

Answer:

The EPA expects that States will expeditiously adopt and submit SIP revisions in order for areas to be eligible for the transitional classification because of the reduced planning burden for those areas, the streamlined NSR and conformity requirements, and because the early reductions will result in earlier attainment of the standard which will provide its citizens with better public health protection. In addition, EPA expects to promulgate a SIP call for areas in the OTAG region that are required to reduce emissions as part of the regional NO_x transport strategy. Failure to comply with the requirements of the SIP call can result in EPA imposing sanctions on the area. Since many areas in the OTAG region will not need a substantial number of additional controls beyond those needed for the regional NO_x transport strategy, such areas should easily qualify for the transitional classification.

Question 7:

How do you plan to decide which other areas are eligible for the "transitional" designation?

Answer:

To be eligible for the transitional classification, areas must meet the 1-hour standard by 2000, the time of designation and classification for the new 8-hour standard. In addition, areas in the OTAG region which are included in the regional NO_x transport strategy must submit a SIP revision which includes the control measures to achieve the regional emission reductions and whatever additional local measures may be needed to demonstrate attainment of the 8-hour standard. Areas not in the OTAG region must submit an early (by 2000) SIP revision which includes whatever measures may be needed to demonstrate attainment of the 8-hour standard. The advantages for areas to obtain the transitional classification are discussed in the response to question 6 above.

Question 8:

Will states have to undertake new modeling to show that they will meet the new ozone standard through the use of the anticipated reductions from a regional control program?

Answer:

The EPA believes that new ozone nonattainment areas in the OTAG region will not need to conduct additional local modeling in those cases where the area will reach attainment through implementation of the regional NOx transpcrt strategy. These areas, as spelled out in the Presidential Directive of July 1997, will be eligible for a special classification of "transitional" provided the State by 2000 submits an implementation plan that includes control measures to achieve the emission reductions required by the EPA's regional NOx reduction rule. Under this approach, these areas would not be required to adopt and implement additional local measures. Therefore, EPA anticipates that it will be able to determine whether such areas will attain based on the extensive OTAG and other regional modeling that has been conducted and that no additional local modeling would be required for these new areas.

However, areas for which a regional transport strategy is not sufficient to attain the 8-hour standard may still be eligible for the transitional classification but in order to receive it must submit an attainment SIP prior to the designation and classification process in 2000. These are areas that will need additional local measures beyond the regional transport strategy in order to attain. The SIP the areas must submit to qualify for the transitional classification must demonstrate attainment of the 8-hour standard and provide for the implementation of the necessary emissions reductions on the same time schedule as the regional NOx reduction strategy. The EPA will work with affected areas to develop a streamlined attainment demonstration.

Question 9:

There has been a lot of talk about how these new standards will interfere with our progress in meeting the existing ozone standard. How does EPA plan to implement the new

standards in areas, such as Los Angeles, that are many years away from meeting the existing standard?

Answer:

If existing control programs are effectively implemented, many existing ozone nonattainment areas classified serious or below may be able to attain the 1-hour ozone standard by the year 2000. Areas classified higher than serious (severe and extreme) will not be able to attain until later years. Areas which cannot attain the 1-hour standard by the year 2000 and thus, are not eligible for the new transitional classification, still have programs underway for the attainment of the 1- hour standard. Under the existing programs, severe ozone nonattainment areas are scheduled to attain the 1-hour ozone standard by either 2005 or 2007. Their work on planning and control programs to meet the 1-hour standard will take them a long way toward meeting the new 8-hour standard. However, some additional local control measures may be needed to achieve the 8-hour standard. Any additional control measures above and beyond those needed to meet the 1-hour standard would probably not need to be implemented until 2005 or later.

In fact, the progressive imposition of controls should provide time for the evaluation and implementation of innovative control measures. The only extreme area in the country, Los Angeles, has an attainment date of 2010. Therefore, Los Angeles may need to implement the additional controls for meeting the 8-hour standard before it has attained the 1-hour standard in 2010. The Administrator of EPA can grant up to two 1-year extensions of the attainment deadlines if the area complies with all requirements and commitments pertaining to the area in the applicable SIP and if the area is experiencing only a minimal number of exceedances of the standard in the attainment and subsequent years..

Question 10:

There seems to be a lot of uncertainty over your projected costs and benefits for both standards. What are some of the major limitations to estimating the costs and benefits associated with full attainment?

Answer:

Both the benefit and the cost estimates associated with full-attainment of the new standards presented in the Regulatory Impact Analysis (RIA) are uncertain. While the air quality, cost, and benefit models employed in the RIA can be used to calculate reasonable estimates of potential partial attainment costs and benefits, they cannot be used to model forcing full attainment in areas not predicted to achieve attainment by year 2010. Methods to estimate the cost of future technologies, needed to fully attain the standards by 2010, and to estimate where control measures will be applied, so that benefits can be reliably estimated, require numerous assumptions.

A rudimentary assessment of full attainment costs is provided in the RIA by assuming that the last increment of reductions can be achieved through the use of unspecified control measures having an average cost-effectiveness of $10,000 per ton of precursor emissions. These full attainment cost estimates are $9.6 billion per year for ozone and $37.6 billion per year for PM. The $10,000 per ton cost estimate for these reductions may overstate future costs given the likelihood of substantial progress in pollution control technology by the year 2010. Obligations to meet national air quality standards create pressures and market opportunities for technology breakthroughs and continuous improvements. The result has been continued, affordable improvements in air quality across the country, even in the face of continued growth in the number of air pollution sources. Clean air challenges have often been met with great success, from alternatives to stratospheric ozone depleters to new super-performing catalysts for automobiles. Examples of technologies not commercially available 10 years ago, but that are now important parts of pollution control programs include: Selective Catalytic Reduction (SCR) for NOx emissions from power plants, gas reburn technology for Nox, scrubbers which achieve 95% SO_2 control on utility boilers, water and powder-based coatings to replace petroleum-based formulations, reformulated gasoline, and LEVs (Low-Emitting Vehicles) that are far cleaner than had been believed possible in the late 1980's (an additional 95% reduction over the 1975 controls).

Such technologies are likely to significantly reduce actual compliance costs associated with the new standards. The RIA, however, did not attempt to estimate cost savings associated with the inevitable development of new technologies.

Question 11:

Since 1990, market-based strategies have been very effective in reducing the costs of attaining existing air quality standards. What new market-based strategies is EPA considering to reduce the costs of attaining the new standards?

Answer:

Several efforts are underway to develop flexible regulatory strategies with the goal of lowering the costs of meeting environmental protection goals. These efforts include a variety of market-based incentive systems. Market-based systems to reduce pollutant emissions have been promoted for many years as an alternative to fixed regulatory standards. National and regional market-based programs such as emissions trading may achieve pollution control goals at dramatically less expense because they allow firms that face high costs to purchase "extra" reductions from firms facing below-average control costs. Such systems are expected to both reduce the costs of compliance and induce more technological innovation in methods of reducing pollution.

The EPA intends to place heavy reliance for implementing revised standards on new or expanded market-based programs instead of command and control regulations. Market-based systems being considered for use in the next 10 years include:

- Cap-and-trade systems for NO_x in eastern (Ozone Transport Assessment Group (OTAG)) and western (Grand Canyon) regions;
- Cap-and-trade system for SO_2 to implement fine particles standard (building on the current acid rain program);
- Cap-and-trade systems for volatile organic compounds (VOC) in major metropolitan areas (modeled on Chicago program now being adopted); and
- "Open market" trading to bring in cost-reducing emission control opportunities from smaller or unconventional sources outside of the cap-and-trade programs.

Another example of a market-based strategy that could reduce control costs without sacrificing pollution control is an investment fund strategy like the "Clean Air Investment Fund". States or EPA could allow firms facing high costs to pay into a fund rather than control emissions themselves. Fund revenues may then be used to purchase additional emission reductions from lower cost sources. The net result of this approach would be to facilitate continued progress on reducing pollution while simplifying compliance for sources choosing to pay into the Fund.

Question 12:

In Montana, farmers burn not only their crop residue in the spring, but also their irrigation ditches. Limitations on burning would make life very difficult for our farmers and ranchers. Is this type of burning going to be a problem under the new PM-2.5 standards?

Answer:

Agricultural burning is a minor contributor to national $PM_{2.5}$ emissions, comprising less than 1 percent of annual $PM_{2.5}$ emissions on average across the East and less than 2 percent across the West. In some instances, however, burning activities can contribute to local $PM_{2.5}$ concentrations. The EPA's approach for addressing emissions from agricultural lands is to work closely with the United States Department of Agriculture (USDA) and to rely on the resource conservation plans and best management practices identified by the local conservation district as reasonably available control measures (RACM), or best available control measures (BACM) on farmlands. This practice is not expected to change. The EPA is currently working on a policy (see question 13 response below) to address smoke impacts from wildland fires through the Federal Advisory Committee Act process. Agricultural burning will also be addressed in this policy, or in a separate policy, in consultation with the USDA's Agricultural Air

Quality Task Force (AAQTF). The EPA and the AAQTF have agreed that more research is needed to improve the level of understanding of agriculture's impact on air quality, including agricultural burning.

The EPA does not directly regulate this activity currently and does not plan to place any additional limits on this type of burning in the future. However, States are free to limit this type of burning if they believe it is a significant source of pollution which contributes to nonattainment in a particular area. Presently, judging the attainment status of any area with respect to $PM_{2.5}$ is impossible for most areas of the country since a comprehensive monitoring network is not yet in place. When an area has collected three years of data from its new monitoring network, redesignations to nonattainment will take place for areas not attaining the new standards. Until this data is collected and chemically analyzed, neither the EPA nor the States will know for any specific area whether burning contributes significantly to $PM_{2.5}$ air quality problems or not.

Question 13:

Secretary Babbitt has stated that he intends to increase prescribed burning to better manage public range and forest lands. Will this be a problem under the new standards? How will the Interior Department coordinate with the EPA and the state agencies responsible for implementing the new standards?

Answer:

The EPA has been working in partnership with several Federal, State and Tribal land management agencies, State air regulators, and other stakeholders to develop a national policy that will address how best to improve the quality of wildland ecosystems (including forests and rangelands) through the increased use of fire, while achieving national clean air goals. We expect to be able to work through the issues and arrive at a policy position that will accommodate the increased use of prescribed burning while minimizing the impact of those fires on public health and the environment. One of the ways the EPA anticipates this goal will be accomplished is through the use of smoke management plans (SMP). SMP attempt to minimize smoke impacts by monitoring fire behavior, meteorology and air quality during a fire, and by making public announcements of forecast smoke conditions in communities affected by ongoing fires. Good smoke management practices may be sufficient in many cases to deal with adverse impacts from wildland fires, including prescribed fires. Alternatives to burning such as mechanical treatment (i.e., physical removal of fuels) and other options will also be advocated by the policy.

Question 14:

Will any area be considered to be in nonattainment for either of the new standards solely because of agricultural activities such as plowing, planting and harvesting crops?

Answer:

The EPA expects agricultural sources to be a very small part of the overall $PM_{2.5}$ problem. It is clear that the major sources of $PM_{2.5}$ are sulfates from power plants (particularly in the Eastern United States), nitrates from power plants and combustion sources, and diesel and other mobile source emissions. In addition, EPA's goal is to site $PM_{2.5}$ air quality monitors in high population areas and other areas likely to have a $PM_{2.5}$ problem. The EPA does not intend to target agricultural areas for monitoring programs or for fugitive dust-related emission control programs. The EPA will continue to work closely with the USDA's Agricultural Air Quality Task Force (AAQTF) on agriculture-related issues. To the extent that any localized air quality problems are identified, the EPA anticipates that any necessary control strategies related to these types of agricultural activities would be developed on a case-by-case basis through a cooperative effort with the local air pollution control office and the local conservation districts or USDA.

Question 15:

How do you plan to handle the designation of rural areas that are downwind from urban areas with particulate problems?

Answer:

Determining the attainment status of any area with respect to $PM_{2.5}$ is not possible since a comprehensive monitoring network is not yet in place (see question 20 response). Accordingly, the EPA will designate all areas of the country as unclassifiable for $PM_{2.5}$ in 1999. [It should be noted that the majority of the new $PM_{2.5}$ monitors will be sited in high population centers and not in rural areas.] When an area has collected three years of data from its new monitoring network, redesignations to attainment or nonattainment will take place. This is consistent with President Clinton's July 16 memorandum to Administrator Browner which states that no new controls will be imposed on sources of $PM_{2.5}$ for 5 years following NAAQS promulgation while air quality monitoring data are being collected and the review of the $PM_{2.5}$ NAAQS has been completed. Until we have this new data and have had an opportunity to analyze it to determine among other things what the source-receptor relationship is, it is premature to speculate on designation approaches for the new $PM_{2.5}$ NAAQS.

Question 16:

Overall, will the new standards provide equal or greater health protection for those living in the West?

Answer:

Overall, the revised PM NAAQS should provide greater health protection to the public in all areas of the U.S., including people living in the West. The new standards for fine

particles were based on the results of the best available scientific studies that show increased mortality and hospitalization for respiratory or cardiovascular diseases, decreased lung function and increased respiratory symptoms to be associated with increased exposure to fine particles. Standards for PM_{10} were left in place because there is evidence that exposure to high levels of coarse particles is also associated with adverse health effects. The new standards are expected to provide an appropriate level of protection against the adverse health effects associated with exposures to both fine and coarse particulate matter.

Question 17:

How long does it typically take to complete a full scientific review of the health effects research? Is there a typical number of times the CASAC panel meets to review and comment on the research?

Answer:

The time it has taken to assess the available health effects research and prepare revised air quality criteria and staff papers has varied from one NAAQS review to another. Such factors as available resources, the ability to schedule CASAC meetings in a timely manner, as well as other factors external to the criteria and standards review process, have affected the amount of time it has taken to complete previous reviews.

For example, during the last review of the PM NAAQS, EPA developed three successive drafts of the joint Criteria Document for PM and Sulfur Oxides (SOx), which added additional complexity to the task, for review by CASAC and the public. Interspersed with the preparation of these drafts, several workshops on different sections of the document were also held. The EPA also prepared two drafts of the PM Staff Paper that were reviewed by CASAC at two separate public meetings. Overall, the scientific assessment phase of the last review of the PM NAAQS, including CASAC's rendering of advice and recommendations for revised standards, was completed two years and three months after formal commencement of the review.

After formally commencing the most recent PM NAAQS review in April 1994, EPA held several workshops on key aspects of the Criteria Document and developed three successive drafts of all or portions of the document. The EPA also prepared two drafts of the Staff Paper. Throughout this process, the public had opportunity to express views at the public workshops, as well as public CASAC meetings on each of the Criteria Document and Staff Paper drafts. Overall, the scientific assessment phase of this review, including recommendations by CASAC and staff that the existing PM_{10} NAAQS be revised, was completed two years and two months after the initial announcement. This is only one month less than it took to reach a comparable point in the previous review.

While there is no "typical" time period for scientific review, similar time periods (two years and some months) were required for scientific assessment in the two previous PM

NAAQS reviews; additional external factors influenced the time period for promulgation of standards following the scientific assessment in the previous PM NAAQS review. It is important to emphasize that there is no prescribed or recommended time period for a review of the scientific literature regarding the NAAQS. There are many factors that can influence the time needed for scientific review that necessitate using more or less time than the two years and some months required for the two recent PM NAAQS reviews.

Question 18:

How many times over what period of time did the CASAC panel meet to review and comment on the health effects of fine particles prior to EPA issuance of the proposed standards for $PM_{2.5}$?

Answer:

Over a ten-month period, CASAC held a number of public meetings to review and comment on drafts of the air quality criteria document and staff paper, as described above. The focus of the earlier meetings was on the assessments of the available health effects information while the last two meetings focused on the basis for the staff's recommendations that fine particle standards be established. More specifically, draft versions of the PM Criteria Document were discussed at hearings on August 3-4, 1995 and December 14-15, 1995, and the health effects studies were one of the major discussion points during these hearings. On February 29, 1996, revisions to four chapters of the Criteria Document were reviewed, but the health effects chapter (Chapter 12) was not included. The hearings held on May 16-17, 1996 were restricted to a discussion of the Staff Paper; the health effects of fine particles were an important component of the Staff Paper, but the findings were those derived from the Criteria Document so the health studies were not reviewed in detail. The health effects associated with exposure to PM were also the topic of discussion in the PM-Mortality workshop that was held in November 1994, and in a series of workshops held in January 1995.

Question 19:

Does CASAC consider research completed and published after the process of collecting relevant research begins? If so, is new research considered throughout the review process? If not, why not?

Answer:

New research that is published or accepted for publication in peer reviewed journals is considered throughout the development of the air quality criteria. Once CASAC has reached closure and the air quality Criteria Document is completed, the EPA Staff Paper is prepared on the basis of the findings in the criteria review; CASAC review and comment is also a component of the Staff Paper preparation. Since the 1970 amendments, EPA has taken the

position that NAAQS decisions are to be based on scientific studies that have been assessed in the air quality criteria review process; this position has been supported in judicial reviews and legislative amendments to the Act. Studies that are published or become available for review after CASAC closure on the Criteria Document are not used in EPA's NAAQS decision, but will be included in the next criteria review process.

Question 20:

Under EPA's implementation plan, three years of PM-2.5 data will not be available by 1998 when States are required under the CAA to submit a list of PM-2.5 nonattainment areas. How does EPA plan to carry out its mandate to designate nonattainment areas under the CAA when insufficient data are available?

Answer:

The first priority for the $PM_{2.5}$ standard is to establish a comprehensive monitoring network to measure ambient concentrations across the country. The initial network, designed and deployed by EPA and the States, and funded by EPA, will consist of approximately 1500 monitors. The monitors will be deployed nationwide between 1998 and 2000 primarily in high population areas. As indicated in the Presidential Directive, the EPA will designate all areas of the country as unclassifiable for $PM_{2.5}$ by 1999. When an area has collected three years of $PM_{2.5}$ data from its new monitoring network, redesignations to nonattainment will take place for those areas not attaining the new standards.

Question 21:

Under EPA's implementation plan, EPA can begin redesignating PM-2.5 areas to attainment or nonattainment in 2002. Section 107(d)(3) of the CAA sets the period for the redesignation process at less than one year. Therefore, the first areas redesignated nonattainment for PM-2.5 under the new standards would submit SIPs by 2005 and begin implementing approved plans by about 2006. If the new standards are by some process overturned and EPA is required to wait until at least 2001 to propose new standards for PM-2.5 --and assuming that sufficient PM-2.5 data is collected during that four year period--what is the earliest that EPA could designate new PM-2.5 nonattainment areas? Following designations, how long does it typically take for States to submit plans, for EPA to review and approve those plans and for States to begin implementing the plans?

Answer:

A review of the current $PM_{2.5}$ NAAQS by CASAC will be conducted within five years to further investigate the causes and mechanisms of $PM_{2.5}$ related health effects. This information will be incorporated into the next periodic review for $PM_{2.5}$ as required by the Clean Air Act and will be assessed prior to the implementation of the current $PM_{2.5}$ standard. By 2002,

the EPA will have determined whether to revise or maintain the $PM_{2.5}$ standard. This determination is expected to be made before any areas have been designated under the current $PM_{2.5}$ standard. If the decision is made to retain the current $PM_{2.5}$ standards, the following implementation schedule applies:

- Monitors in place in 1998-2000
- High population/high risk areas designated nonattainment in 2002 (other areas designated 2003-2005)
- States submit plans for high population/high risk areas in 2005 (plans for other areas submitted 2006-2008)
- High population/high risk areas meet standards in 2007-2014 (other areas meet standards 2008-2017)

If the implementation of the new $PM_{2.5}$ standards is delayed for any reason beyond the schedule, the consequences to public health could be very adverse. It is estimated that every year of delay of the new PM and ozone standards would result in up to approximately 15,000 premature deaths, 75,000 cases of chronic bronchitis, 375,000 asthma attacks and, over 3 million work days lost.

In addition, the delay would result in numerous other adverse health effects. Such effects include reduced pulmonary function, cancer, other chronic respiratory diseases, infant mortality, increased susceptibility to respiratory infection, pulmonary inflammation, acute inflammation and respiratory cell damage and premature aging of the lungs. Finally, there are also many unquantified welfare effects including effects on vegetation, forests and other natural ecosystems, as well as materials damage, visibility impairment and other adverse welfare effects.

EPA'S RESPONSES TO QUESTIONS FROM SENATOR LIEBERMAN

Question 1:

Will EPA consider approaching the issue of offsets for areas currently required to have offsets through a regional program with an emission budget cap, such as the one being discussed by EPA now?

Answer:

Yes; EPA believes it is appropriate to extend the use of a regional offset system to ozone nonattainment areas which are not classified as "transitional," since many of these areas also experience ambient ozone problems resulting from the transport of ozone precursors originating outside the areas where violations are being measured. This fall, EPA will be meeting with stakeholders to discuss how best to address offset requirements in areas which will be designated and classified as transitional nonattainment for the new 8-hour ozone standard, as well as in existing nonattainment areas for the 1-hour ozone standard. EPA will then propose regulatory amendments to its NSR requirements in early 1988 and take final action by December 1988, as indicated in the President's directive of July 16, 1997.

Question 2:

What will EPA do to ensure that the existing nonattainment areas be able to fully and adequately account for (including being given credit for) the effects of transport entering these areas from both regional and neighboring states with respect to the regulatory obligations in these existing nonattainment areas?

Answer:

President Clinton's July 16, 1997 memorandum to the Administrator of EPA directed that:

> "1. Implementation of the air quality standards is to be carried out to maximize common sense, flexibility, and cost effectiveness" and
>
> "2. Implementation shall ensure that the Nation continues its progress toward cleaner air by respecting the agreements already made by States, communities, and businesses to clean up the air, and by avoiding additional burdens with respect to the beneficial measures already underway in many areas. Implementation also shall be structured to reward State and local governments that take early action to provide clean air to their residents; and <u>to respond to the fact that pollution travels hundreds of miles and crosses many State lines</u>." (Emphasis added).

Attached to that memorandum was an Implementation Plan for the Revised Air Quality Standards which included a section on Regional Strategy. That section directed EPA to propose rules in September 1997 requiring States in the OTAG region that are significantly contributing to nonattainment or interfering with maintenance of attainment in downwind States to submit SIPs to reduce their interstate pollution. The EPA must issue the final rule by September 1998. If a State fails to respond to those requirements, EPA can sanction the State.

Attachment 1

Control Strategies Contained in Model Run 5 of the Ozone Transport Assessment Group

UTILITY

Mandated CAA controls

* Acid Rain Controls [Phase 1 & 2 for all boiler types]
* RACT & NSR in nonattainment areas without waivers

Additional controls

* OTC NOx MOU (Phase II)
* 85% reduction from 1990 rate or rate-base of 0.15 lb/mmbtu for all units, whichever is less stringent

NON-UTILITY POINT SOURCES

Mandated CAA controls

* RACT at major sources in nonattainment areas without waivers
* 250 Ton PSD and NSPS **(not modeled)**
* NSR in nonattainment areas without waivers **(not modeled)**
* CTG & Non-CTG RACT at major sources in nonattainment areas & throughout OTC
* New Source LAER & Offsets for nonattainment areas **(not modeled)**
* "9% by 99" ROP Measures (VOC or NOx) for serious and above areas

Additional controls

* NOx Controls based on cost per ton of reduction (< $1,000 per ton)

  - Primarily LNB technology

NONROAD MOBILE

Mandated CAA controls

* Fed Phase II Small Eng. Stds
* Fed Marine Engine Stds

* Fed HDV (>=50 hp) Stds-Ph.1
* Fed RFG II (Statutory and opt in areas)
* 9.0 RVP maximum elsewhere in OTAG
* "9% by 99" ROP Measures (VOC or NOx) for serious and above areas

Additional Controls

* Fed Locomotive Standards (including rebuilds)
* HD Engine 4gm Standard

HIGHWAY MOBILE

Mandated CAA controls

* Tier 1 light-duty and heavy-duty Stds
* Federal reformulated gas (RFG II) (Statutory and opt in areas)
* High Enhanced I/M (Serious and above areas)
* Low Enhanced I/M for rest of OTR
* Basic I/M (Mandated areas)
* Clean Fuel Fleets (Mandated areas)
* 9.0 RVP maximum elsewhere in OTAG
* On board vapor recovery

Additional Controls

* National LEV
* Heavy Duty Vehicle 2 gm std
* Federal Test Procedure (FTP) revisions
* "9% by 99" ROP Measures (If substitute for VOC) in serious and above areas

OTHER AREA SOURCE CONTROLS

Mandated CAA controls

* Two Phases of Consumer & Commercial Products & one Phase of Architectural Coatings
* Stage 1 & 2 Petroleum Distribution Controls-NAAs
* Autobody, Degreasing & Dry Cleaning Controls in NAAs
* "9% by 99" ROP Measures (VOC or NOx) (Serious and above areas)